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Chicago, October 12, 1929 (*Issued Every Other Week*) Volume XXXII, No. 21

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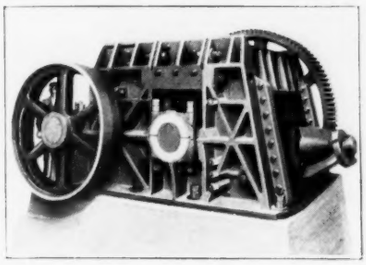

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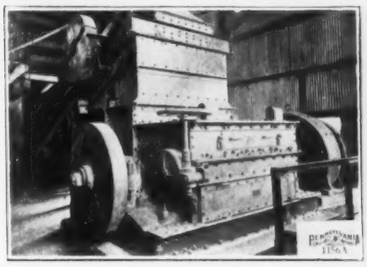

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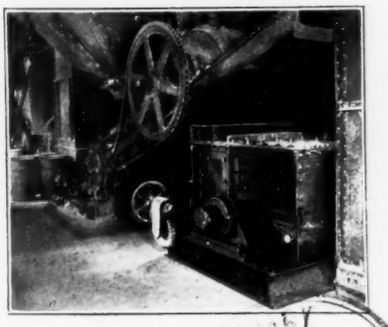
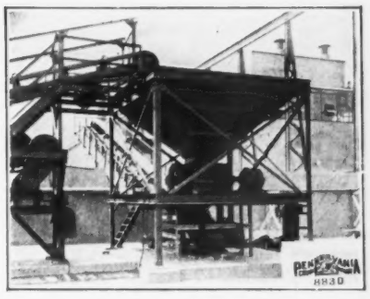


SAMSON Series, size SXT-[illegible] *STEELBUILT* Hammermill making the "fine grind" of "Easy Work" burned lime.



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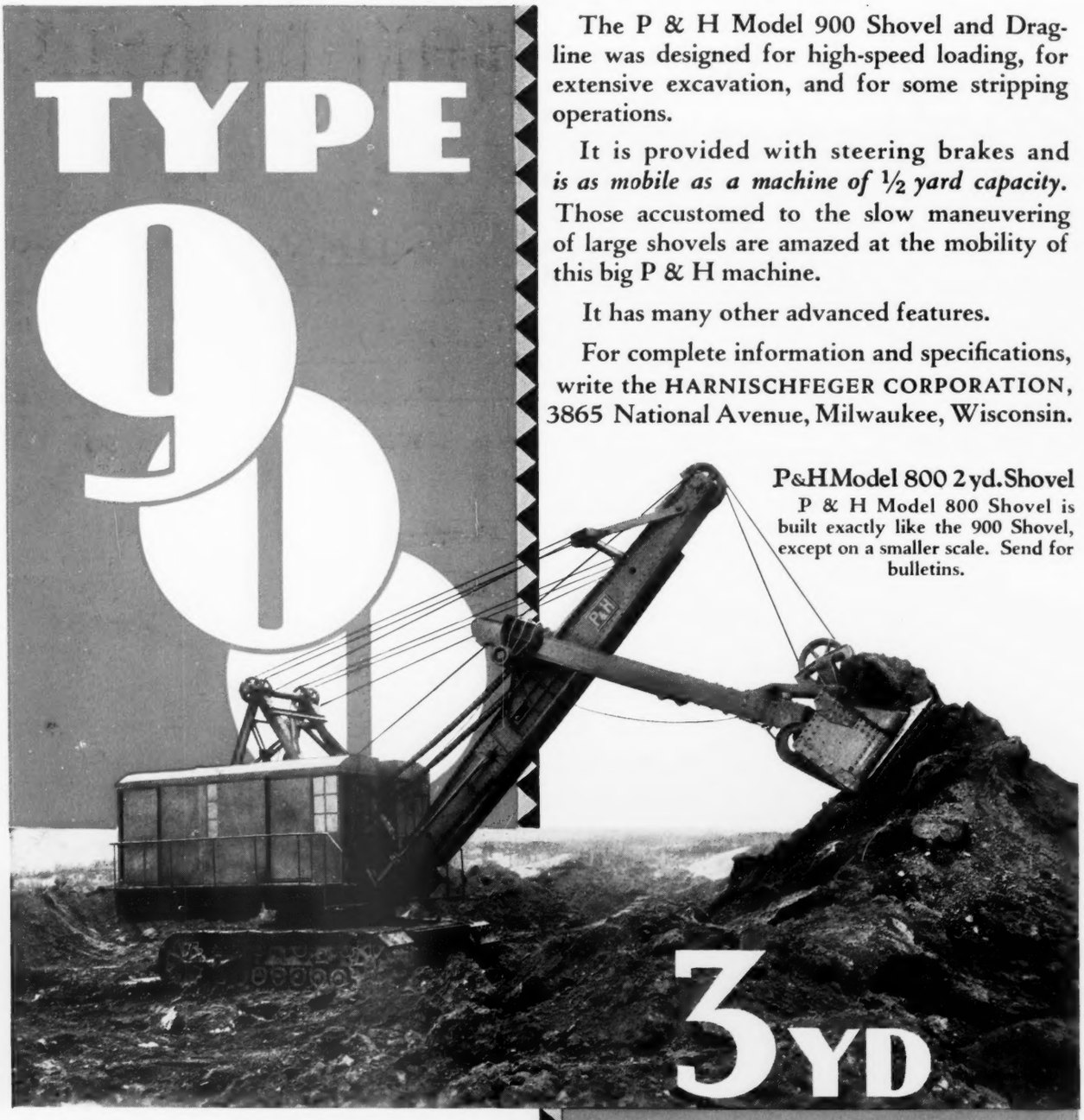

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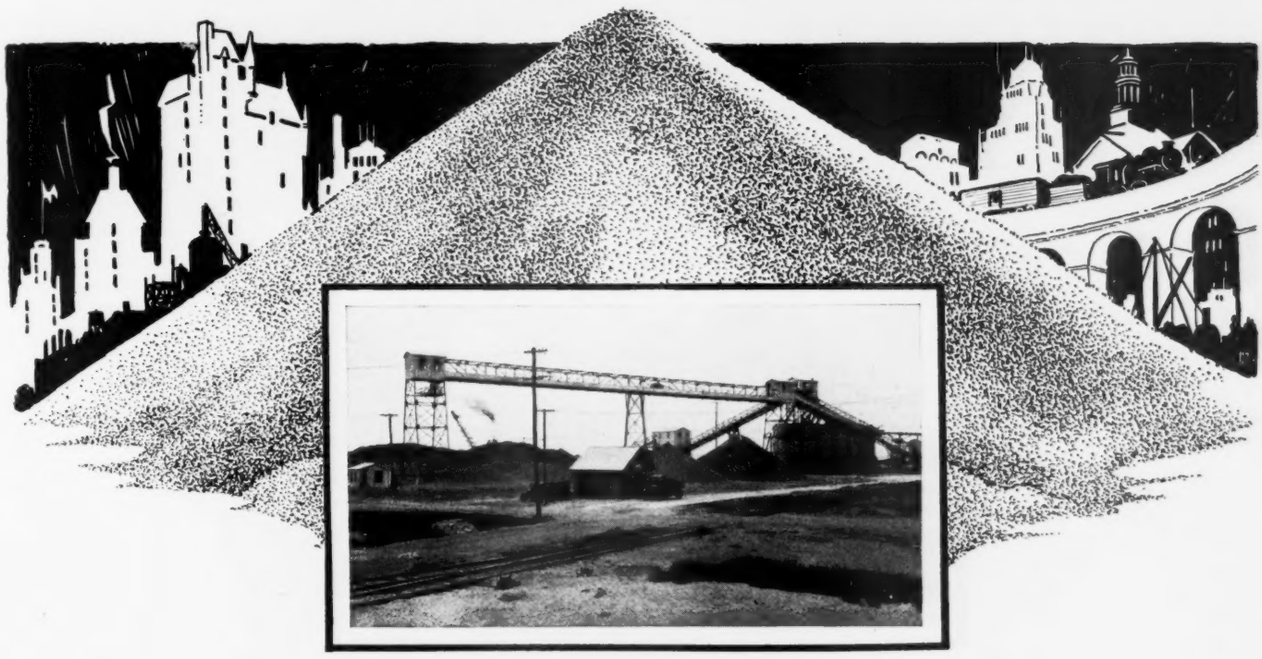

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Rock Products
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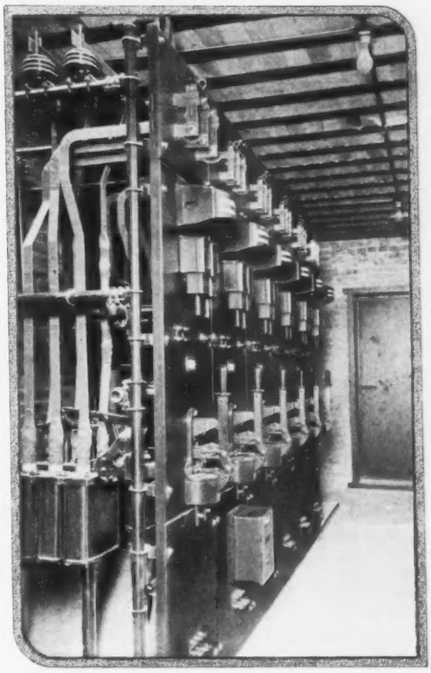
Volume XXXII Chicago, October 12, 1929 Number 21

The Chazy Marble Lime Co.

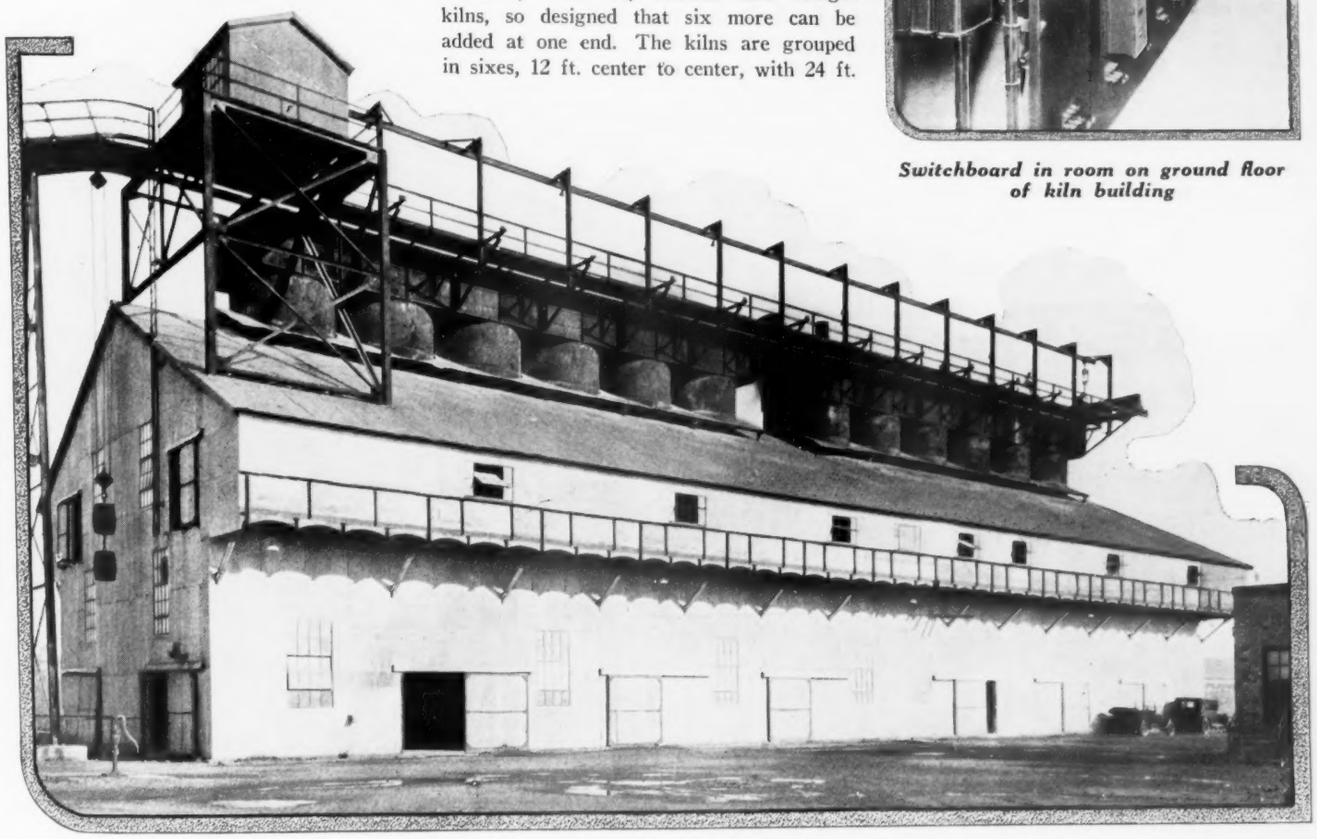
Undoubtedly One of the Best Shaft-Lime-Kiln Plants in America

THOUGH the plant of the Chazy Marble Lime Co., Chazy, N. Y., is not one of the newest, it is one of the best, if not in some ways the best shaft, lime-kiln plant in this country—and this is the first description of it ever published. It was constructed in 1924-25 and no expense was spared to provide the best in layout and equipment. The company is a subsidiary of the Delaware and Hudson Co. and is an outgrowth of a limestone quarry long operated at Chazy to supply fluxstone for the Chateaugay Ore and Iron Co. at Lyon Mountain, N. Y., another Delaware and Hudson enterprise, and other New York State blast furnaces.

The lime plant consists of a battery of 12 standard, coal-fired, Arnold and Weigel kilns, so designed that six more can be added at one end. The kilns are grouped in sixes, 12 ft. center to center, with 24 ft.



Switchboard in room on ground floor of kiln building



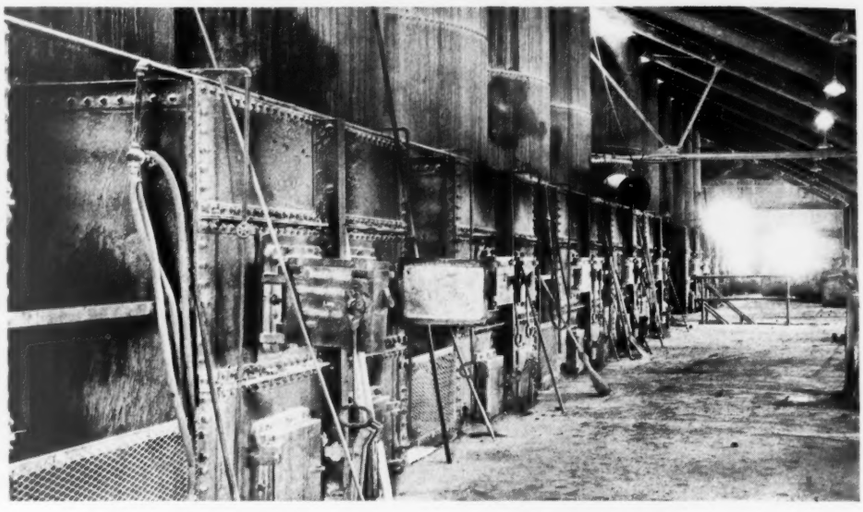
General view of the lime plant of the Chazy Marble Lime Co., Chazy, N. Y.

View showing storage plant (left background) and locomotive crane and coal hopper

between the two groups—on a straight line. They are fed with limestone from a 3 ft. 2½-in. gage, center track over the tops of the kilns, 56 ft. above the draw floor level and 36 ft. above the firing floor, which is 19 ft. above the draw floor. The 12 kilns have a rated capacity of 1200 bbl. (150 tons) per day.

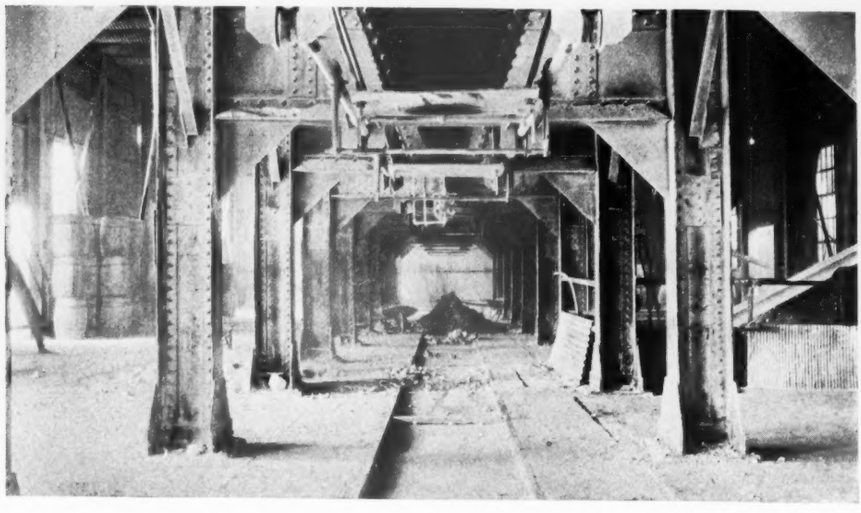
The kiln building is structural steel on concrete foundations with corrugated metal siding, 175 ft. long by 50 ft. wide. The kilns are completely housed, with a ventilated roof around the kilns' shells, as shown in one of the views. The kiln building has an offset or overhang of 8½ ft. at the firing floor, on each side, thus providing ample coal storage space opposite the kiln furnaces.

The limestone is brought to the top of the kilns by an incline—a steel trestle—by means of a 3½-ton Watt mine car—hauled by a Lidgerwood single-drum hoist. The hoist is powered by 60-hp., General-Electric induction motor, controlled by a drum type controller with an oil circuit-breaker resistor. A concrete counterweight brings the car back to the top of the incline. At present the limestone is brought by motor truck in large fragments from the fluxstone quarry, about a half mile distant, to the foot of the incline, broken to kiln size and loaded into the car by hand. Eventually the same stratum of limestone will be mined at the foot of this incline.

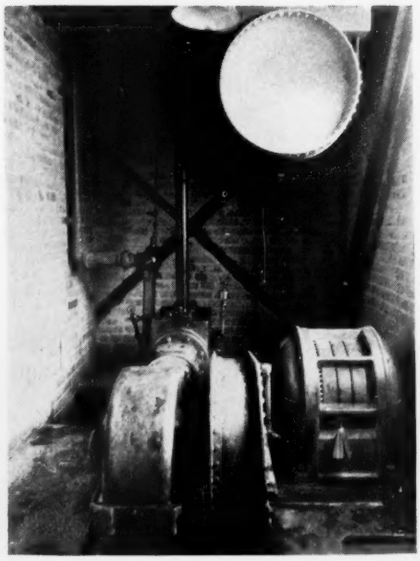


Firing floor of kiln house—steam used under grates

Coal is brought in on railway cars on a Delaware and Hudson R. R. siding, serving the plant, and is placed in a coal bin at one end of the plant by a railroad type Browning steam locomotive crane. From this bin a Ford 1-ton truck, on hard rubber tires, delivers the coal to the furnace tenders, or lime burners, on the firing floor. A high volatile, low sulphur bituminous coal is used. Two 60-hp. Erie City boilers supply steam at 60-lb. pressure to use under the grates.



Drawing floor of kiln house showing industrial railway track under kilns

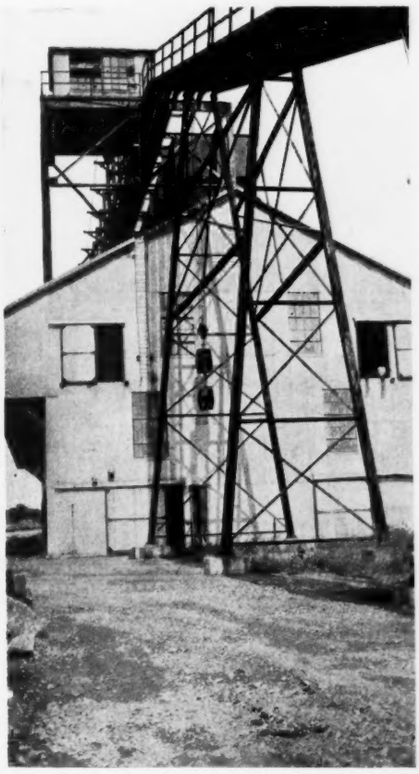


Automatically controlled air compressor in kiln house

On the draw floor, which is approximately at ground level, in one corner, is a completely, brick-enclosed, compressor room, containing an automatically controlled 9 x 8, single-stage, Ingersoll-Rand compressor driven by a 25-hp. G.-E. induction motor through an enclosed Morse silent chain drive. This compressor supplies the air for

the Jackhamer drills used to break up the large stone at the foot of the incline, and for the Curtis air-hoists which operate the draw shears on the kilns. The intake is equipped with a Staynew air filter.

Also on the main floor of the kiln building is a dust-proof, brick enclosure housing

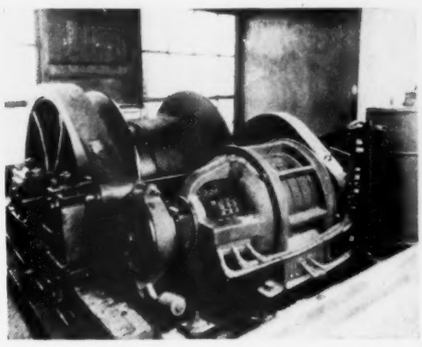


Trestle and counterweights for returning car

the switchboard for all the motor controls in the kiln building and hydrate building. This switch board is equipped with oil switches, Thomson ammeters, and reverse, time-limit overloads. All motors in the plant are provided with push-button emergency stop switches, as well as with the standard switch equipment, in enclosed boxes.

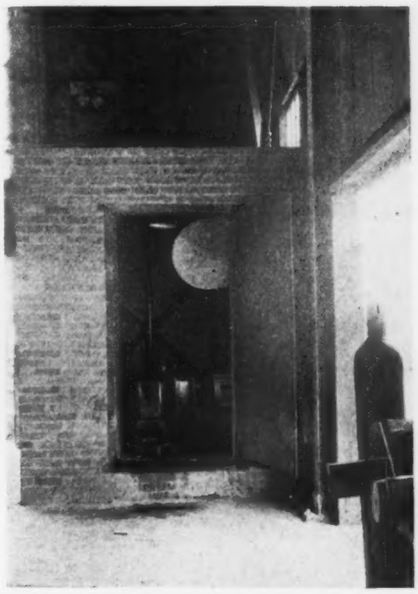
View from mine site

Under the centers of the kilns on the draw floor level is an industrial railway track, 3 ft. 2⅛-in. gage, with a 2-ton car into which the lime may be drawn, although it

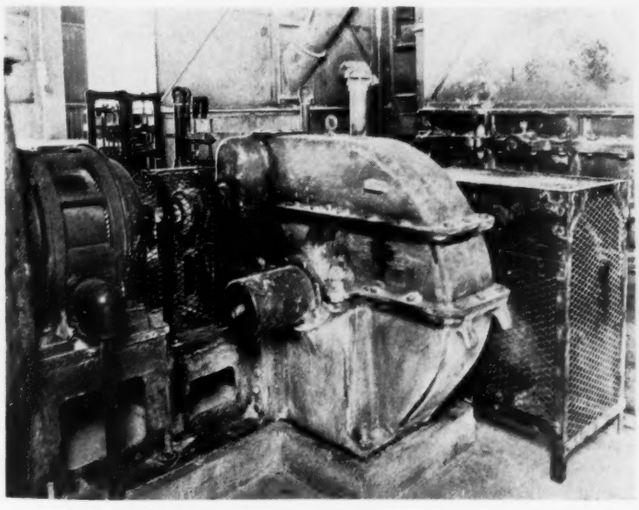


Hoist for kiln incline

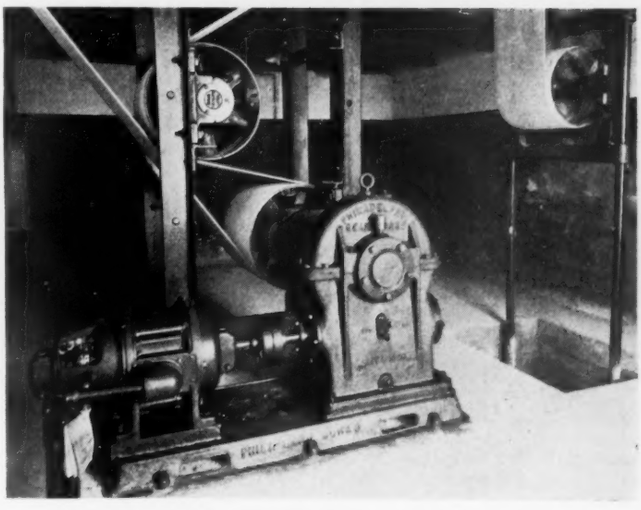
may be drawn on the floor direct, for hand sorting. This car is side-dumped into a steel hopper in the center of the kiln house,



Compressor room in kiln house



Hydrator room showing typical motor drives



Conveyor belt drive unit in warehouse—in center of belt

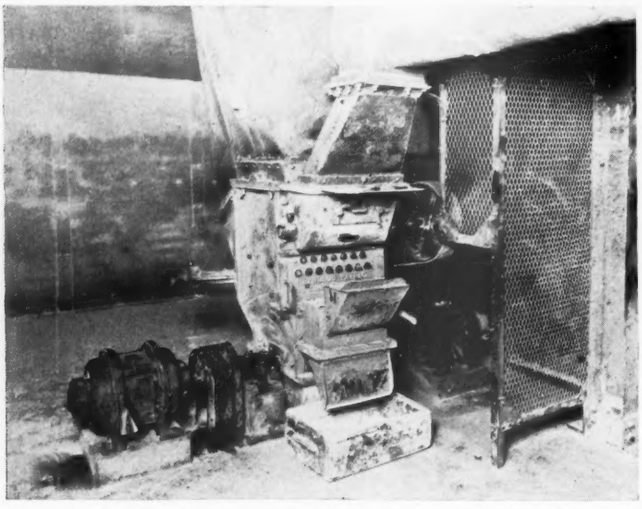
Filtered air intake for air compressor

Looking over the tops of the kilns

which feeds an 18-in. Jeffrey steel-pan conveyor, driven by a 5-hp., 780 r.p.m., G.-E. enclosed type induction motor, through a Palmer-Bee, 156 to 1, geared speed reducer.

The pan conveyor feeds an SX2 Pennsylvania hammer mill, in the center of the kiln house, on the side nearest the hydrate plant. The hammer mill is direct-connected to a 30-hp. G.-E. motor running at 1140 r.p.m.

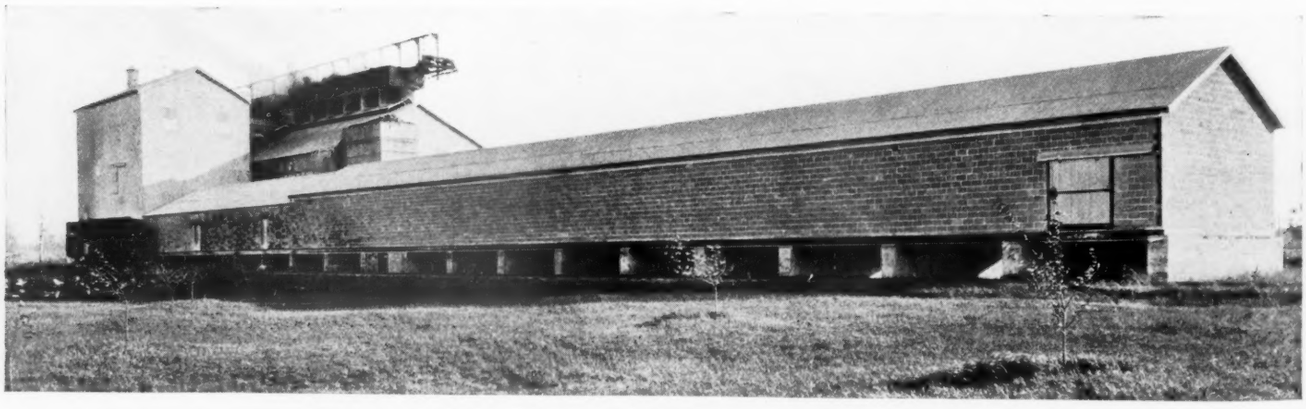
Hammer mill drive in kiln house



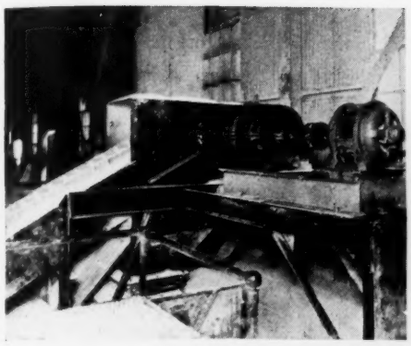
Typical hydrate mill drive

A Jeffrey chain-bucket elevator takes the product of the hammer mill to an enclosed screw conveyor leading from the top of the kiln house to the top of two 60-ton crushed lime bins in the hydrator building. This elevator is driven by 10-hp. G.-E. motor (770 r.p.m.) through a Palmer-Bee geared speed reducer, 40.5 to 1.

The hydrate plant consists of two Weber batch hydrators, one of which is driven by a 10-hp., 1160 r.p.m. G.-E. motor connected with a 1160 to 1 Palmer-Bee speed reducer through a Palmer-Bee flexible coupling; the other by a 15-hp., 770 r.p.m. motor through a Falk speed reducer, 800 to 8.95. The hy-

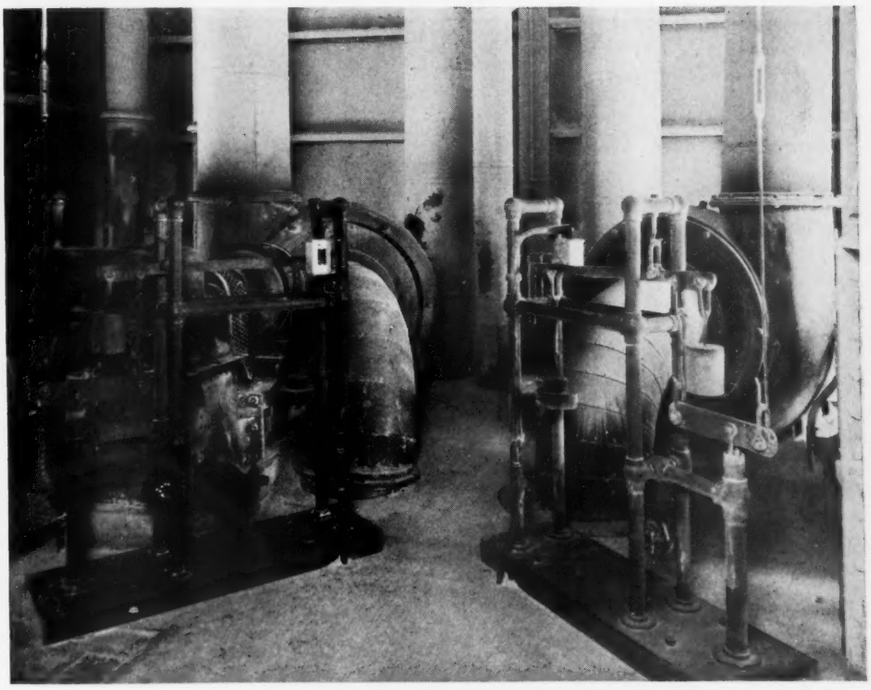


The lime warehouse—floor at car-floor level—fireproof throughout



Pan conveyor and drive—feeding pulverizer in kiln house

drator bins are filled by a screw conveyor under the 60-ton crushed lime storage bins and an elevator, which is driven, along with the screw conveyor by a 5-hp., 780 r.p.m., G.-E. motor by means of a Palmer-Bee reducer, 20.8 to 1. Starting and stopping of this screw and elevator are controlled automatically by a clever device on the two beam scales which weigh the lime batches for the hydrator, the essence of which is a G.-E. float switch which stops the elevator



Hydrate plant interior, showing automatic batch control scales

Quarry face is 2000 ft. long

feeding one batch hopper and diverts the flow to the other hopper, or if only one hydrator is in use it shuts down the feed screw and elevator until the batch hopper has been emptied, which releases the scale and starts the feeding operation automatically.

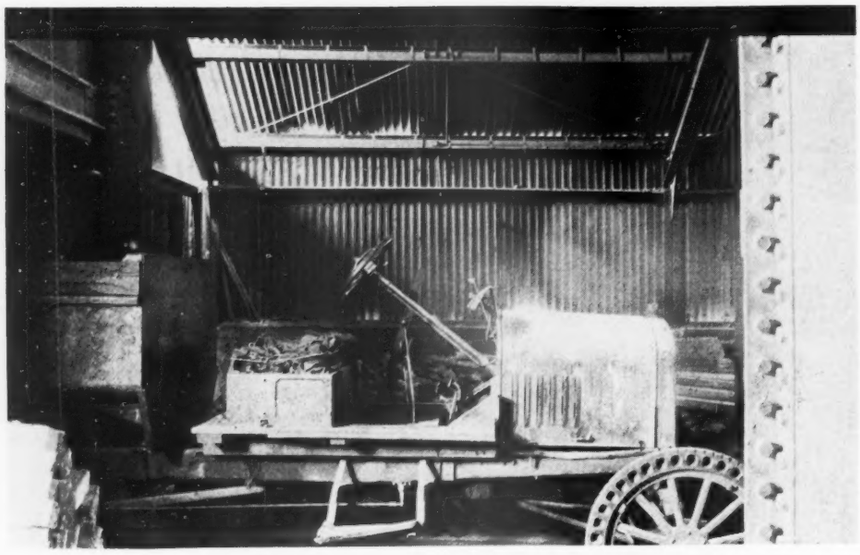
The hydrators discharge to screw conveyors which carry the hydrate to the feed bins of two No. 0 Raymond mills, each direct connected to 10-hp., 1160 r.p.m., G.-E. motors. These feeder bins are equipped with Raymond feeders of the roll-mill type to insure a constant rate of feed. The feeders and screw conveyors on the mills are belt driven from a shaft, which is driven by a 10-hp., 770 r.p.m. G.-E. motor.

One Raymond mill and air separator is used for making mason's hydrate. The other mill and separator makes a chemical hydrate, one of the finest and purest on the market, being 99.5% through 300-mesh. This is made in the new Pool type Raymond separator, said to be one of the first to be used in the lime industry.

Chazy lime is very high in calcium oxide content with low silica and impurities, and no expense has been spared to insure and maintain a high quality of product—both lump lime and hydrate.

The warehouse and shipping room, on the end of the hydrate building, is a concrete-block structure 300 ft. long by 30 ft. wide. In the end nearest the hydrate building are two 4-valve Bates bag packers, each driven by a 7½-hp., 1140 r.p.m. G.-E. motor. A complete dust collecting system protects the workmen bagging lime. The lime is shipped out of this building on either side, to cars on sidings paralleling the warehouse.

Showing character of stone and fracture



Truck used to distribute coal on firing floor of kiln house

The larger part of the floor space in the warehouse is devoted to the storage of bagged lime. For handling the bags a 16-in. U. S. Rubber Co. belt conveyor runs the length of the building, on the center line, 284 ft. c. to c. This conveyor was made by the Variety Iron Works and is equipped with Timken roller bearings. It is driven from the center by a 5-hp., 1170 r.p.m., G.-E. motor through a Philadelphia Gear Works, 60 to 1, reducer, of the worm-gear, right-angle type, using an Ajax coupling.

The motor drive is in a basement compartment, the floor of which is about ground level, below the floor of the warehouse.

Special Features

The electrical equipment of the plant is the best that could be had at the time the plant was built. Power is received at 22,000 v., 3-phase, 40-cycle, so that all motors are more or less special. This power is stepped down in an outside transformer station to 550 v. Adjacent to the transformer station is a separate brick building housing the main switchboard for the high tension lines. This is equipped with oil-emersed cut-outs, with voltmeters and ammeters on the individual switches serving various parts of the plant. All wiring from this main switchboard to the plant and between various parts of the plant is in conduit.

All the electrical equipment was furnished by the General Electric Co., and the electrical layout was designed by the Chazy Marble Lime Co.'s electrical engineers.

Quarry

As already noted the stone comes from the same quarry which supplies the fluxstone crushing plant about one-half mile distant. This quarry is remarkable for its long straight face—approximately 2000 ft. long—and the low silica, high lime content of the stone. Three all-electric Clipper well drills, with caterpillar traction, are used for drilling the face, which is about 30 ft. high. Holes 4-in. in diameter and 10 ft. centers are used. For secondary drilling Ingersoll-Rand Jackhamers are used, air being supplied by two electrically-driven compressors in the quarry, one 6x8-in. and the other 8x10-in. of the Ingersoll-Rand portable type. Three 1-yd. Erie steam shovels do the loading.

Looking down on what will be the mine entrance—from top of kilns

Type of quarry car used

Transportation to the crushing plant is by means of a 45-in. gage track and all-steel, front dump cars holding 2 cu. yd. each. The locomotives are two 4-ton Vulcan, gasoline-powered.

The primary breaker is a 32 x 18-in. Acme jaw crusher. All screening is done with four Hum-mer vibrating screens.

J. R. Linney, vice-president of the Chateaugay Ore and Iron Co., Lyon Mountain, N. Y., is also vice-president of the Chazy Marble Lime Co.; D. K. Evans, a mining engineer, is manager of the Chazy operations; Robert Miller is quarry superintendent, and Clyde Cook is superintendent of the lime plant. The original design for the lime plant was made by Arnold and Weigel, Woodville, Ohio.

Market Survey of Gypsum Products*

A Study of the Industry from an Economic Viewpoint

By R. M. Santmyers
Mineral Specialist, U. S. Bureau of Mines

THE INCREASING USE of gypsum, especially in building construction, emphasizes the need for careful analysis of the basic factors of marketing gypsum products. In the past, plants were erected where likely deposits were present and little thought was given to the real potentialities of a market, beyond a simple faith in the growing demand in nearby territory. As a result there are plants in several states today that are an economic detriment to the industry, for they must seek markets far from the source of production or attempt to enter the logical markets of other plants through the profitless gateway of price cutting.

Within the past decade, and more especially within the last two years, there has been a growing tendency among operators to study markets and to analyze labor conditions before building a plant. Certain of the larger companies, though still having regard to sources of raw materials, are today erecting plants at strategic centers of consumption. In some cases—for example, where cheap water transportation is available—the raw materials may be brought to the plant over fairly long distances. For most gypsum products the manufacturing process adds very little to the ultimate weight of the finished goods, and the rates on crude gypsum are, of course, substantially less than upon finished products made therefrom. The conditions of transportation, however, should be known beforehand; otherwise the odds are against marketing the product at prices that will assure the return of the capital invested.

Editor's Note

OUR UNDERSTANDING is that this investigation and report was made primarily to furnish information to the United States Tariff Commission and Congressional Committees now dealing with the tariff, although the text of the report as issued to us makes no mention of this.

The report is abstracted at quite some length here not because of its bearing on the tariff problem, or controversy, nor even entirely because it deals with gypsum products; but because it furnishes the rock products industry with an example of a comprehensive economic and market survey—something that ROCK PRODUCTS has long advocated, as our readers are well aware.—The Editor.

Gypsum is marketed in three distinct forms: (1) As crude rock for use as a retarder in the portland cement industry; (2) as ground crude gypsum for fertilizer, and as a filler in paint, paper, cloth, etc.; and (3) as calcined gypsum, which is used principally in building construction.

In the present report the marketing of each of these forms of gypsum will be discussed separately, and then the distribution of the gypsum mills will be considered with particular reference to the market areas which they serve. Finally an analysis will be made of some of the fundamental factors relative to plant location, sales territories, and distribution. Table 1 shows the production and sales of gypsum in the United States from 1890 to 1927, and Table 2 gives the production by states throughout the same period.

Consumption by Cement Plants

During the past decade the sales of crude gypsum have increased 100%, due largely to increased purchases by cement mills. In 1928 the total sales of crude gypsum amounted to 470,192 short tons, of which the portland cement plants took 403,635 tons, or 86%. For 1927 the total sales were 965,371 short tons, of which the cement mills took 928,307 tons, or 96%. Consider-

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TABLE 1. PRODUCTION AND SALES OF GYPSUM IN THE UNITED STATES, 1890-1927

		Sold crude			Ground into land plaster			Calcined and plaster of Paris				
Year	Total quantity	Quantity, short tons	Value	Price per ton	Quantity, short tons	Value	Price per ton	Quantity, short tons	Value	Price per ton	Total value of sales	Sold as crude
1890	182,995	18,742	$19,148	$1.02	56,525	$143,014	$2.53	79,257	$412,361	$5.20	$574,523	10%
1891	208,126	18,574	28,690	1.54	51,700	117,356	2.27	110,006	482,005	4.38	628,051	9
1892	256,259	58,080	80,797	1.39	47,668	106,247	2.23	106,141	508,448	4.79	695,492	23
1893	253,615	42,808	71,860	1.68	50,408	106,365	2.11	122,937	518,390	4.22	696,615	17
1894	239,312	34,702	56,149	1.62	41,996	95,944	2.28	127,158	609,626	4.79	761,719	15
1895	265,503	26,624	37,837	1.42	35,079	85,355	2.43	150,801	674,255	4.47	797,447	10
1896	224,254	17,302	19,134	1.11	27,354	59,749	2.18	137,505	494,461	3.60	573,344	8
1897	288,982	23,164	27,020	1.17	31,562	67,083	2.13	180,935	661,761	3.66	755,864	8
1898	291,638	5,758	7,200	1.25	40,929	90,777	2.22	190,083	657,303	3.46	755,280	2
1899	486,235	58,352	66,762	1.14	50,033	100,797	2.01	286,227	1,119,521	3.91	1,287,080	12
1900	594,462	35,479	44,127	1.24	45,682	82,806	1.81	396,284	1,500,270	3.79	1,627,203	6
1901	633,791	68,669	71,773	1.05	59,058	109,551	1.85	399,686	1,325,317	3.31	1,506,641	11
1902	816,478	81,455	93,914	1.15	60,791	106,237	1.75	539,387	1,889,190	3.50	2,089,341	10
1903	1,041,704	73,912	87,608	1.19	74,601	154,945	2.08	742,543	3,550,390	4.78	3,792,943	7
1904	940,917	56,137	61,234	1.09	70,167	142,490	2.03	665,340	2,580,601	3.88	2,784,325	6
1905	1,043,202	67,105	106,041	1.58	40,196	74,280	1.85	736,708	2,848,906	3.87	3,029,227	6
1906	1,540,585	186,999	460,545	2.46	62,671	157,292	2.50	899,581	3,220,138	3.58	3,837,975	12
1907	1,751,748	232,546	424,227	1.82	46,851	115,841	2.47	1,125,301	4,402,196	3.91	4,942,264	13
1908	1,721,829	209,031	334,009	1.60	37,672	91,623	2.43	1,125,617	3,650,192	3.24	4,075,824	12
1909	2,252,785	292,274	448,814	1.54	49,581	103,695	2.09	1,514,037	5,354,229	3.54	5,906,738	13
1910	2,379,057	368,014	559,172	1.52	53,815	110,325	2.05	1,583,669	5,853,532	3.70	6,523,029	15
1911	2,323,970	334,600	491,906	1.47	52,880	97,573	1.85	1,598,418	5,872,556	3.67	6,462,035	14
1912	2,500,757	388,543	516,464	1.33	53,065	107,058	2.02	1,731,674	5,940,386	3.43	6,563,908	16
1913	2,599,508	408,321	601,113	1.47	54,815	95,953	1.75	1,773,849	6,077,756	3.43	6,774,822	16
1914	2,476,465	390,742	549,083	1.41	52,945	97,716	1.85	1,656,066	6,249,190	3.77	6,895,989	16
1915	2,447,611	406,393	528,161	1.30	69,256	122,714	1.77	1,613,720	5,946,018	3.68	6,596,893	17
1916	2,757,730	465,240	623,294	1.34	81,879	167,136	2.04	1,805,814	7,168,602	3.97	7,959,032	17
1917	2,696,226	539,627	893,562	1.66	84,366	230,808	2 74	1,677,390	9,992,082	5.96	11,116,452	20
1918	2,057,015	405,621	980,836	2.42	64,571	255,716	3.96	1,328,269	10,234,302	7.70	11,470,854	20
1919	2,420,163	470,267	1,332,637	2.83	39,978	185,566	4.64	1,596,020	14,209,704	8,90	15,727,907	19
1920	3,129,142	561,817	2,007,270	3.57	107,443	557,925	5.19	1,904,484	21,967,870	11.53	24,533,065	18
1921	2,890,784	537,978	1,775,109	3.30	104,966	490,902	4.68	1,796,851	21,434,279	11.93	23,700,290	19
1922	3,779,949	668,821	2,056,143	3.07	101,904	387,203	3.80	2,491,265	26,917,805	10.80	29,361,151	18
1923	4,753,448	821,816	2,427,410	2.95	25,426	150,026	5.90	3,101,378	32,310,719	10.42	34,888,155	17
1924	5,042,629	959,810	2,548,708	2.66	22,298	125,612	5.63	3,568,569	40,050,187	11.22	42,724,507	19
1925	5,678,302	988,134	2,669,327	2.70	26,001	153,902	5.92	4,096,357	44,754,011	10.93	47,577,240	17
1926	5,635,441	934,069	2,357,969	2.52	27,294	151,916	5.57	4,015,974	44,211,334	11.01	46,721,219	17
1927	5,346,888	935,919	2,258,838	2.41	29,452	129,825	4.41	3,912,211	39,785,791	10.17	42,174,454	18

able quantities of crude gypsum are imported from Canada, Mexico and other foreign countries. Canada, however, furnishes the larger part of the foreign gypsum, most of which is consumed along the Atlantic seaboard at cement plants, as land plaster, and for the manufacture of gypsum building-construction materials.

In recent years there has been a considerable increase in the tonnage of imported gypsum that is sold in the crude state. During 1927 eight companies reported imports amounting to 785,476 short tons of crude gypsum, of which 107,307 tons was sold crude, all to cement plants except about 12,000 to 15,000 tons, which was used as a fertilizer in Virginia and North Carolina. This is a decided increase over previous years and will no doubt show additional increases in the future as the requirements for cement grow.

A considerable amount of crude domestic gypsum will be shipped by water from Alabaster, Mich., on Lake Huron, to Detroit and Chicago upon completion of plants at these two points. This will be the first time in recent years that domestic crude gypsum will be shipped inland for fabrication at places other than at point of production, and no doubt will create a saving in the cost of handling the finished products, as the potential markets at these localities are sufficiently large to absorb the entire output of the fabricating plants.

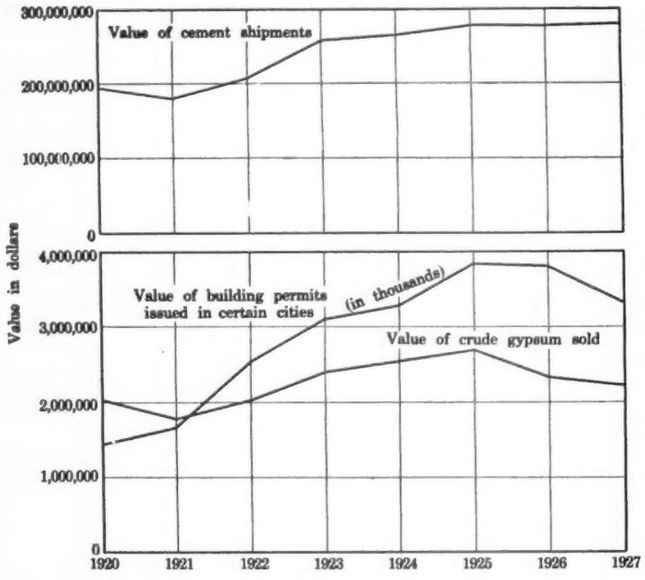


Fig. 1. Comparison of value of sales of crude gypsum to cement plants with value of cement shipments and of building permits issued

In the west some crude gypsum from Mexico is shipped direct to cement plants both before and after crushing to size. Although the figures are not as large as those in the eastern states ,they compare favorably with total imports of the crude rock. According to figures published by the Bureau of Foreign and Domestic Commerce, the Imports of crude gypsum rock from Mexico in 1927 amounted to 63,387 short tons, valued at $62,035. The importers, however, state that during that year some 51,000 tons were brought in, of which about 2100 tons was sold crude.

The use of gypsum in the portland cement industry is steadily increasing and when the results of using anhydrite (which is often asociated with gypsum) become better known, it will likewise be used for the same purpose as gypsum. According to Table 1, the sales of crude gypsum to cement plants for the years 1920 to 1927 have averaged 799,446 short tons annually—the high year was 1925, when 988,134 tons was sold, as compared with 537,978 tons in 1921, the low year.

At several plants the crude gypsum is passed through screens. Many cement mills accept readily everything that passed a 3-in. ring. Other mills, on account of the nature of the feeding devices used, require smaller sizes and a few mills insist that the fines be taken out. In order to compete successfully for cement-mill busines, gypsum plants must be near the cement mills. Due to its relatively low value per ton, crude gypsum is unable to stand a long freight haul. Some cement companies mine and crush their own gypsum, but this is far from being the common practice.

Crude gypsum is usually shipped to cement mills in bulk. The mills ordinarily keep a stock of two or three weeks' supply on hand and try to time shipments of gypsum into the mills with those of cement going out. For this reason they may require the gypsum to be loaded into box cars; otherwise either box cars or drop-bottom hopper cars are used.

TABLE 2. GYPSUM PRODUCTION IN THE UNITED STATES BY STATES, 1890-1927 (SHORT TONS)

Year	Iowa	Kansas	Michigan	Nevada	New York	Ohio	Oklahoma	Texas	Utah	Virginia	Other states	Total mined	Value of sales
1890	20,900	20,250	74,877	.....	32,903	12,748	.....	.....	.....	6,350	14,967	182,995	$574,523
1891	31,385	40,217	79,700	.....	30,135	9,123	.....	.....	3,000	5,959	13,327	212,846	647,451
1892	12,000	46,016	139,557	.....	32,394	13,275	.....	1,926	2,600	6,991	1,500	256,259	695,492
1893	21,447	43,631	124,590	.....	36,126	11,646	.....	4,011	.....	7,014	5,150	253,615	696,615
1894	17,906	64,889	79,958	.....	31,798	20,827	1,300	6,925	1,920	8,106	5,683	239,312	761,719
1895	25,700	72,947	66,519	.....	33,587	21,662	13,100	10,750	2,134	5,800	13,304	265,503	807,447
1896	18,631	49,435	67,634	.....	23,325	22,634	8,000	16,022	2,866	5,955	9,752	224,254	573,344
1897	29,430	54,353	94,874	.....	33,440	18,592	10,734	24,454	2,700	6,374	14,031	288,982	755,864
1898	24,733	59,180	93,181	.....	31,655	21,303	3,150	34,215	2,610	8,378	13,233	291,638	755,280
1899	75,574	85,046	144,776	.....	52,149	27,205	23,526	53,773	2,352	11,480	10,354	486,235	1,287,080
1900	184,600	48,636	129,654	1,000	58,890	39,034	24,937	80,622	2,397	11,940	12,752	594,462	1,627,203
1901	213,419	(1)	185,150	.....	119,565	.....	15,930	(1)	.....	15,236	84,491	633,791	1,506,641
1902	295,769	(1)	240,227	.....	110,364	101,545	34,156	(1)	.....	(2)	34,417	816,478	2,089,341
1903	307,102	(1)	269,093	.....	137,886	103,392	69,158	(1)	.....	(2)	155,073	1,041,704	3,792,943
1904	145,359	173,721	238,385	.....	158,892	101,809	53,523	(3)	.....	(2)	69,228	940,917	2,784,325
1905	179,016	47,276	299,585	.....	153,367	134,276	148,947	(4)	.....	(2)	80,735	1,043,202	3,029,227
1906	286,857	105,091	341,716	.....	288,631	132,805	247,937	(4)	.....	(2)	137,548	1,540,585	3,837,975
1907	251,874	155,980	317,261	.....	324,507	202,253	282,461	(4)	.....	(2)	217,412	1,751,748	4,942,264
1908	240,270	130,184	327,810	.....	318,046	178,904	272,193	(4)	.....	(2)	254,422	1,721,829	4,075,824
1909	319,577	137,697	394,907	.....	403,929	289,517	338,526	(4)	.....	(2)	368,632	2,252,785	5,906,738
1910	322,713	135,088	357,174	103,329	467,339	292,987	162,788	188,559	46,279	(2)	302,801	2,379,057	6,523,029
1911	354,204	122,579	347,296	133,960	472,834	360,858	108,653	179,625	(5)	(2)	243,961	2,323,970	6,462,035
1912	411,186	131,031	384,297	122,408	506,996	262,551	135,074	160,863	.....	(2)	386,351	2,500,757	6,563,908
1913	456,031	110,510	423,896	.....	529,627	254,863	147,876	161,090	.....	.....	515,615	2,599,508	6,774,822
1914	480,404	80,774	393,006	.....	523,368	265,091	113,103	158,814	44,950	.....	416,955	2,476,465	6,895,989
1915	495,860	60,919	389,791	.....	540,914	259,036	110,790	176,306	23,445	.....	390,550	2,447,611	6,596,893
1916	522,293	78,257	457,375	.....	579,827	286,678	161,661	197,785	.....	.....	473,854	2,757,730	7,959,032
1917	461,864	79,331	375,803	.....	606,268	270,538	158,017	257,328	.....	.....	487,077	2,696,226	11,116,452
1918	327,927	54,958	286,768	.....	531,038	199,456	126,208	157,388	.....	.....	373,272	2,057,015	11,470,854
1919	421,279	78,479	339,125	91,756	591,153	251,259	114,313	176,607	.....	.....	356,192	2,420,163	15,727,907
1920	571,895	130,044	382,212	143,929	780,295	277,899	135,279	220,157	.....	.....	487,432	3,129,142	24,533,065
1921	350,247	92,526	408,224	178,275	712,665	363,905	209,201	232,806	.....	.....	342,935	2,890,784	23,700,290
1922	536,905	105,481	471,355	276,859	1,055,302	435,485	242,932	221,914	48,338	.....	385,378	3,779,949	29,361,151
1923	685,041	135,019	586,987	298,390	1,361,116	526,861	290,121	344,104	44,531	.....	481,278	4,753,448	34,888,155
1924	727,385	141,908	577,526	365,714	1,474,491	525,485	316,134	402,245	90,221	.....	421,520	5,042,629	42,724,507
1925	800,167	166,952	649,053	350,130	1,730,254	551,479	320,931	558,132	.....	.....	551,204	5,678,302	47,577,240
1926	802,910	195,440	659,685	350,972	1,723,460	521,205	324,021	533,156	36,333	.....	488,259	5,635,441	46,721,219
1927	792,159	175,351	668,617	327,365	1,675,501	474,320	271,484	508,382	.....	.....	453,709	5,346,888	42,174,454

NOTES—(1) Included in Iowa figures (both Kansas and Texas). (2) Included in Ohio figures (Virginia); Ohio, 1902, figure also included California. (3) Included in Kansas figures (Texas). (4) Included in Oklahoma figures (Texas). (5) Included in Nevada figures (Utah); Nevada, 1910, figure included Oregon.

TABLE 3. SALES OF CRUDE GYPSUM TO CEMENT PLANTS AND TOTAL SALES OF PORTLAND CEMENT COMPARED

	Crude gypsum sold		Portland cement sold	
Year	Quantity*	Value	Quantity*	Value
1920	561,817	$2,007,270	18,106,603	$194,439,025
1921	537,978	1,775,109	17,955,344	180,778,415
1922	668,821	2,056,143	22,127,829	207,170,430
1923	821,816	2,427,410	25,551,478	257,684,424
1924	959,810	2,548,708	27,456,939	264,046,708
1925	988,134	2,669,327	29,571,499	278,524,108
1926	928,885	2,326,635	30,491,173	277,965,473
1927	928,307	2,237,548	32,310,569	278,854,647

*In short tons.

Agricultural Uses

Practically the first use for gypsum in the United States was for land plaster, and down to the year 1889 nearly two-thirds of the quarried gypsum was used for this purpose. In the early 70's the mills of Michigan could not supply the demand, though they were run day and night, and the material sold at a high price of $4.50 per ton. In 1890 the uses of gypsum in this country were reversed in ratio, and nearly twice as much rock was calcined as was used for fertilizer. By 1893 the proportion was three to one, and in 1898 the amount of gypsum calcined was six times that ground into land plaster. Today it is about 14 times as great.

One cause for this change was a growing doubt as to whether land plaster actually produced the wonderful results that had been claimed for it; certain writers tried to show that the benefits derived were not permanent. Another factor was the increasing popularity of commercial fertilizers composed of various ingredients. Big companies were organized over the country, which, aided by large capital, careful preparation of materials, and judicious advertising, were ble to sell at a reasonble price patent phosphate fertilizers, embodying the good points of gypsum and having other valuable qualities in addition.

At the present time the largest consumption of gypsum as a land plaster is in the peanut-growing areas of Virginia and North Carolina, where between 12,000 and 15,000 tons are used annually. This concentration of demand is explained by the fact that gypsum appears to be essential to the growing of the large Virginia (or Jumbo) peanut, which is the one commonly sold in the shell from the peanut roaster. Though a good fertilizer for the smaller Spanish nut (which is used in vending machines and by candy-makers), gypsum is not so essential for this type, and consequently relatively small amounts of gypsum fertilizers are used in Georgia, Alabama, and Texas, where the Spanish variety is mainly grown.

For most crops, but particularly for alfalfa, considerable quantities of agricultural gypsum are used in Washington and Oregon. In these states the soil in many localities is strikingly deficient in sulphate sulphur, and this deficiency is supplied most cheaply and effectively by the application of finely ground gypsum. In California and some other western states considerable quantities of gypsum are used to neutralize black alkali.

The use of gypsum in the grain belt in the Central States has been showing a more or less steady decrease. Here the soy bean has usurped considerable acreage devoted in the past to corn. Another factor that may have contributed to the falling off of land plaster sales in the middle west is the aggressiveness of farmers' community associations in furnishing limestone. These associations purchase limestone in carload lots and sell it to the farmers in any desired quantities on deferred payments. In the majority of cases they deliver the stone to the farmer's back door from the railroad cars.

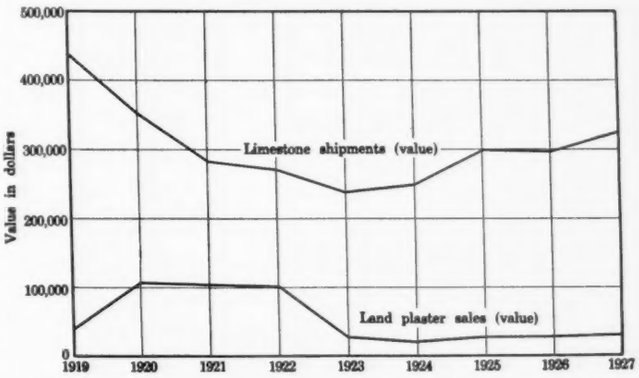


Fig. 2. Comparison of gypsum land plaster sales with limestone shipments

As may be seen from Table 4 and Fig. 2, the sales of gypsum as land plaster increased to an exceptionally large amount during the otherwise depression years of 1920, 1921 and 1922. It was during this period that the gypsum industry carried on an extensive advertising campaign in favor of gypsum as a fertilizer, but the dominant cause for this sudden increase was the necessity for renewing soils exhausted by intensive farming during the war years. In 1923, on the other hand, the sudden slump in the sales of ground gypsum for agricultural use represents a return to normal conditions. The greatest falling off occurred in Iowa, where the sales droped from 45,062 short tons in 1922 to 329 tons in 1923; in Michigan, where they fell from 13,054 to 616 tons; and in New York, which showed a shrinkage from 13,708 to 1249 tons. Since 1923 the sales have increased only very slightly.

TABLE 4. COMPARISON OF SALES OF GYPSUM AND LIMESTONE FOR USE AS FERTILIZER

	Sales of gypsum as land plaster		Sales of limestone for fertilizer	
Year	Quantity, short tons	Value	Quantity, short tons	Value
1918	64,571	$255,716	391,047	$2,698,848
1919	39,978	185,566	438,632	3,345,039
1920	107,443	557,925	351,851	3,096,705
1921	104,966	490,902	284,722	2,237,510
1922	101,904	387,203	272,726	2,005,082
1923	25,426	150,026	240,551	1,825,519
1924	22,298	125,612	248,336	1,864,514
1925	26,001	153,902	296,976	2,129,169
1926	27,294	151,916	297,010	2,153,233
1927	29,452	129,825	322,893	2,237,871

Building Construction Materials

All gypsum wall plasters have other materials added to the calcined gypsum either before sacking or just before wetting for use. These plasters, commonly known as hard-wall plasters (of which there are many brands), may be grouped into four classes, namely: (1) Cement plaster—calcined gypsum, retarder, and with or without hair; (2) wood-fibre plaster—calcined gypsum, retarder, and wood fibre; (3) prepared plaster—calcined gypsum, retarder, sand and hair or wood fibre; and (4) finishing plaster—calcined gypsum, with or without retarder, and with or without hydrated lime.

Plaster board, a relatively new product, has contributed largely to the rapidly growing use of gypsum in the building construction industry in recent years. It may be divided into three classes, namely: (1) Wall board, to be used without plaster; (2) plaster board, upon which plaster is to be applied; and (3) gypsum lath, a plaster board of smaller dimensions which is used to replace wood or metal lath.

Another group of gypsum products which has forged rapidly into popular favor comprises gypsum blocks and tile. These are used for partitions, both load-bearing and non-load-bearing, floors, roofs and furring.

Keene's cement, one of the oldest products manufactured from calcined gypsum, has followed the general upward trend of the other gypsum building materials. It con-

TABLE 5. PRODUCTION OF GYPSUM AND SALES OF CALCINED GYPSUM IN THE UNITED STATES

	Gypsum produced	Sales of calcined gypsum	
Year	Short tons	Short tons	Value
1890	182,995	79,257	$ 412,361
1891	208,126	100,006	482,005
1892	256,259	106,141	508,448
1893	253,615	122,937	518,390
1894	239,312	127,158	609,626
1895	265,503	150,801	674,255
1896	224,254	137,505	494,461
1897	288,982	180,935	661,761
1898	291,638	190,083	657,303
1899	486,235	286,227	1,119,521
1900	594,462	396,284	1,500,270
1901	633,791	399,686	1,325,317
1902	816,478	539,387	1,889,190
1903	1,041,704	742,543	3,550,390
1904	940,917	665,340	2,580,601
1905	1,043,202	736,708	2,848,906
1906	1,540,585	899,581	3,220,138
1907	1,751,748	1,125,301	4,402,196
1908	1,721,829	1,125,617	3,650,192
1909	2,252,785	1,514,037	5,354,229
1910	2,379,057	1,583,669	5,853,532
1911	2,323,970	1,598,418	5,872,556
1912	2,500,757	1,731,674	5,940,386
1913	2,599,508	1,773,849	6,077,756
1914	2,476,465	1,656,066	6,249,190
1915	2,447,611	1,613,720	5,946,018
1916	2,757,730	1,805,814	7,168,602
1917	2,696,226	1,677,390	9,992,082
1918	2,057,015	1,328,269	10,234,302
1919	2,420,163	1,596,020	14,209,704
1920	3,129,142	1,904,484	21,967,870
1921	2,890,794	1,796,851	21,434,279
1922	3,779,949	2,491,265	26,917,805
1923	4,753,448	3,101,378	32,310,719
1924	5,042,629	3,568,569	40,050,187
1925	5,678,302	4,096,357	44,754,011
1926	5,635,441	4,015,974	44,211,334
1927	5,346,888	3,912,211	39,785,791

sists of dead-burned gypsum, generally heated to 900 to 1100 deg. F., to which the property of quicksetting is restored by the use of certain salts.

Tables 5 and 6 show the production of crude gypsum and sales of calcined gypsum in the United States for the years 1890 to 1927, inclusive, and the division of sales into the several products for the same years.

More Calcined Plaster Made

It may be seen from Table 6 that a rapidly growing proportion of the crude gypsum was used for calcining into plaster of paris, etc. It was not, however, until the beginning of the 20th century that the greatest increase in use of calcined products took place. About that time gypsum wall board, plaster board, block, and tile were first put on the market in quantity, and met with practically immediate success. At the same time, sales of gypsum wall plaster in all grades assumed noteworthy proportions; it is estimated that between 80% and 90% of the calcined gypsum produced was used for this purpose. This may be due, especially in certain years, to the demand for plaster "staff" used in the construction of temporary buildings. The great increases in 1902 and 1903 were the results of the demand for this plaster at the Louisiana Purchase Exposition at St. Louis, and the decrease in 1904 represented the return to a normal trend; but, as may be seen from the table, the trend during the next six years turned sharply upward as a result of the remarkable growth in the production of plaster, and during 1909 reached 1,514,037 tons.

This normal trend held steadily during the 10-year period up to the beginning of the World War, the net increase being about 104% in the sales of calcined gypsum.

In 1915 two expositions were held in California, the Panama-Pacific Exposition at San Francisco and the Panama-California Exposition at San Diego. The large quantities of plaster "staff" required for these temporary buildings were the principal causes for the growth in the sales of plaster of paris during 1912 and 1913. Practically all the gypsum for the Panama-California Exposition and at least 80% of that for the Panama-Pacific Exposition buildings was quarried near Nephi, Utah.

Consolidations within the industry constituted its outstanding feature during the four years prior to the World War. With consolidations came higher and more stable prices. The greatest increases in the price of calcined gypsum, however, came in the war years, 1917 to 1919. In 1915, calcined gypsum sold for an average of $3.68 per short ton. In 1917, however, the price advanced to $5.96 per ton and then increased rapidly until in 1921 it reached the highest in the history of the industry, $11.93 per ton. Consolidations within the industry still form the outstanding feature, and the practice of economy with closer competition has had the effect of reducing the price of calcined gypsum; in 1927, it fell to $10.17 per ton.

The price of land plaster followed closely the trend in the price of calcined gypsum, with the exception that the height was not reached until 1925. In 1915, prior to our entry into the World War, land plaster was sold for $1.77 per short ton. This price rose rapidly during the World War and reached its maximum in 1925, when it was sold for $5.92 per ton. Since then there has been a downward trend to $4.41 per ton in 1927.

The price of crude gypsum in 1915 was $1.30 per ton, the lowest since 1904. The rapid rise in price during the war years, reaching $3.57 per ton in 1920, was followed by a downward trend to $2.41 per ton in 1927.

While there has been a downward trend in the prices of gypsum and gypsum products during the past few years, there is nevertheless a substantial gain—in some cases over 200%—over those prices prevailing prior to the World War.

Shipping of Gypsum Building Materials

Gypsum building materials, especially plasters, because of their rapid deterioration in the presence of moisture, are usually shipped in sound box cars, although in emergencies shipments have been made on tarpaulin-covered flat cars. For wall plasters the minimum carload varies from 15 to 30 tons. The smaller minimum ordinarily carries a somewhat higher rate and is used in shipping to small towns where there might be some deterioration of the plaster in the warehouse before a large carload could be disposed of.

Wall plaster is always sold in bags, either of jute or of paper. Jute bags contain 100 lb. (net) each. They are charged for separately at a price which, though it varies from time to time more or less in accordance with the market price of jute, generally averages $3 per ton of plaster.* These bags, provided they are returned in good condition, carriage prepaid, within six months, are redeemed by the shipper at the same price originally charged for them. The time limit of six months is merely nominal; plaster manufacturers often will redeem bags returned even two or three years later.

The jute-bag department is an important feature of a large mill and adds greatly to the warehouse space required and to the work of the accounting department. Because of this trouble and expense the gypsum plaster industry has made determined efforts to encourage shipments in paper instead of jute bags, and within the past two years these efforts have met with remarkable success. To reduce breakage the contents of the paper container is limited to 80 lb., so that 25 instead of 20 bags are needed for each ton of plaster. For gypsum plaster shiped in paper the extra charge for bags is from $1 to $1.50 per ton of plaster, and the bags are not redeemable. When shipments are made in paper, the floor and sides of the car must be lined with felt paper or old burlap to prevent perforations, and 25 or more empty bags are sent with each car to replace any broken in transit.

With the improved styles of self-closing multiwall paper bags and the machines used for filling them, it seems likely that practically all plasters will be shipped in paper containers before long.

Plaster board, wall board, lath, and blocks and tiles are usually shipped in box cars and require only nominal shoring to keep the material in place. Lath is put up in 6 and

*Wilder, F. A., Marketing of Gypsum. *Eng. and Min. Jour. Press;* vol. 117, No. 10, March 8, 1924, pp. 403-406.

TABLE 6. GYPSUM PRODUCED AND SOLD IN THE UNITED STATES* (SHORT TONS)

Use	Quantity–1922–Value	Quantity–1923–Value	Quantity–1924–Value	Quantity–1925–Value	Quantity–1926–Value	Quantity–1927–Value
Calcined:						
Stucco	396,990 $2,813,561	455,161 $3,106,333	600,955 $3,849,971	634,714 $3,930,714	543,729 $3,365,116	421,987 $2,493,910
Neat plaster	1,333,261 12,126,811	1,536,077 13,061,700	1,712,589 13,895,969	2,187,721 16,737,733	2,150,243 16,066,220	2,069,945 14,324,857
Sanded plaster	80,455 1,165,771	178,016 1,191,473	166,910 1,179,826	184,850 1,331,784	133,255 869,208	207,210 1,414,749
Mixed plaster	†218,650 †1,914,572	†268,271 †2,373,276	†193,635 †1,534,836	....	....	....
Plaster of Paris, molding, casting plaster, etc.	‡126,288 ‡1,198,819	‡155,295 ‡1,585,585	‡193,971 ‡1,903,493	‡187,058 ‡1,888,941	‡206,226 ‡2,014,926	‡173,080 ‡1,542,916
Keenes cement	21,991 324,316	23,273 323,127	30,620 428,684	36,607 503,397	42,436 603,781	41,431 674,698
To plate-glass works	....	21,435 163,358	18,847 138,444	19,536 148,398	14,589 114,767	18,372 132,203
Plaster board	42,088 945,171	68,431 727,562	86,018 1,924,394	110,703 2,766,079	166,866 3,194,194	249,219 4,669,562
Wall board	120,591 4,500,725	197,218 7,131,668	391,457 12,859,411	422,863 13,812,230	444,056 14,408,796	415,082 11,165,965
Partition tile	68,338 915,449	134,437 1,537,783	121,604 1,492,550	245,853 2,542,228	231,571 2,476,807	231,044 2,102,985
Special tile or blocks	44,834 368,068	22,456 293,512	23,457 345,847	8,654 97,408	28,730 315,097	21,701 280,436
Other purposes§	37,779 644,542	41,308 815,342	28,506 496,762	57,798 995,099	54,273 782,422	63,140 983,510
Total calcined	2,491,265 $26,917,805	3,101,378 $32,310,719	3,568,569 $40,050,187	4,096,357 $44,754,011	4,015,974 $44,211,334	3,912,211 $39,785,791
Crude	770,725 2,443,346	847,242 2,577,436	982,108 2,674,320	1,014,135 2,823,229	961,363 2,509,885	965,371 2,388,663
Total value	$29,361,151	$34,888,155	$42,724,507	$47,577,240	$46,721,219	$42,174,454

*Mineral Resources of the United States, Bureau of Mines. †Includes small quantity of wood-fibre plaster. ‡Includes dental plaster and plaster sold to plate-glass works. §Includes roof tile and material used for pointing up wall boards; and insulating material, fireproofing, etc., after 1924.

9 sheet bundles which weigh about 60 lb. They are protected along the edges by heavy kraft paper and are loaded into box cars in the same maner as blocks and tile.

Distribution of Gypsum Products Plants

In 1927, as shown in the table below, there were 60 plants in operation in the United States. This figure represents only those plants that calcine domestic gypsum and is the lowest with the exception of that for 1926 (59 plants) for the past eight years. It may also be seen that the plants which use domestic gypsum are well distributed throughout the United States, except in New England, in the southeast, and in the Pacific northwest. In the New England states, California, and the Pacific northwestern states, there are additional plants, but they are not shown in the table because they use imported gypsum; those in New England obtaining their rock from Nova Scotia and those in the latter two localities importing rock from San Marcos Island, Lower California, are not shown.

The southeastern section of the United States is the only one in which there are no plants treating either foreign or domestic gypsum. This is explained in part by the absence of known commercial deposits of gypsum and in part by relatively small local demand. Increased demand, however, is indicated by reports that a gypsum-products plant is being erected at Tampa, Fla., to utilize calcium sulphate waste from phosphoric-acid manufacture.

The manufacture of gypsum products is becoming more and more centralized at points of consumption. There is considerable new construction underway, but as new plants are built, obsolete or badly situated plants will be closed down or dismantled. Table 7 shows the number of plants in the United States using domestic gypsum.

Correlation of Gypsum Sales and General Building Construction Figures

The sales of calcined gypsum in the United States—at least for the period, 1920-1927, follow closely the value of new buildings as shown by permits issued.

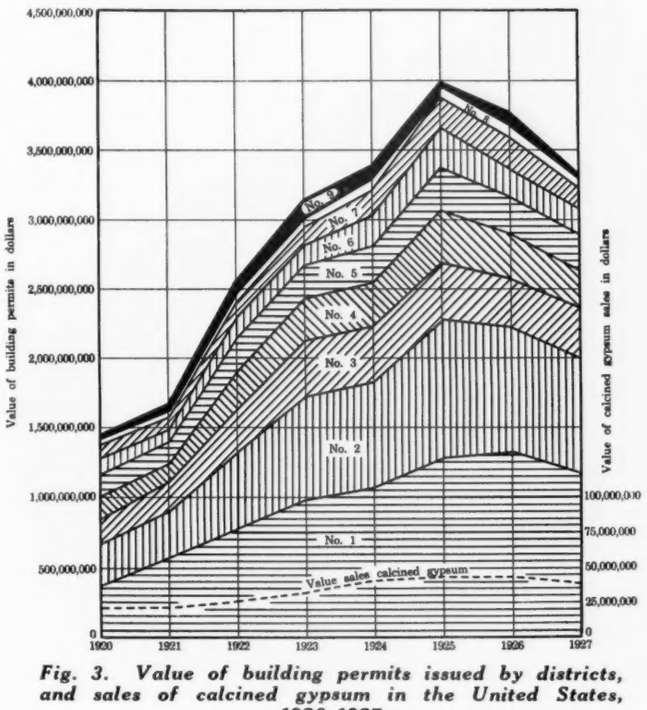


Fig. 3. Value of building permits issued by districts, and sales of calcined gypsum in the United States, 1920-1927

The close correlation between these two sets of yearly figures for the country as a whole is shown clearly in Fig. 3 and Table 8. Moreover, an analysis of the detailed tables herein presented shows that a similar correlation exists with respect to the leading subdivisions of the country, indicating that each of the smaller areas, with the exception of the Southeastern States, is relatively self-contained as regards supplies of finished gypsum products for its local markets.

For the purpose of studying this phase of the gypsum industry, the United States has been arbitrarily divided into nine districts (disregarding New Mexico and Nevada, where the volume of new buildings is too small to have much effect upon the total for the United States, though both States produce and manufacture gypsum products.) These districts correspond to the territorial classification employed in the bulletin of the Portland Cement Association, which in turn was based on Bradstreet's and the American Contractor's building statistics.

Table 9 shows the location and number of kettles and kilns and their capacities for 1927.

DISTRICT 1—In 1927 district 1, comprising New York State and northern New Jersey, issued building permits to the value of $1,168,161,000, or 36% of the total of $3,338,522,000 for the United States in that year. The industry in this district is situated in the vicinity of Akron, at Newburg, at New York City, and at Newark, N. J.; the latter plant, however, closed down in 1928. In 1927, the 15 producers operating in these four fields produced and sold 1,573,910 short tons of calcined gypsum valued at $17,-934,419, or 40% of the total value of the sales ($44,811,681) for that year. The daily capacity of the plants in operation is estimated at 8660 tons, or about 32% of all the plants in the United States. Since 1927, however, new plants have ben put in operation, using imported Canadian crude gypsum or waste calcium sulphate from the manufacture of chemicals.

DISTRICT 2—The second largest district (No. 2) as regards value of new building permits, comprises the Middle-Western States. In this group gypsum products are actually manufactured from domestic material in only four states: Iowa, Michigan, Kansas and Oklahoma; but the other states, Illinois, Indiana, Wisconsin, Missouri and Nebraska, all fall in the same market area. This district isued building permits to the value of $826,340,000 in 1927, or 25% of the total issued in the United States. For the four states in this district that manufactured gypsum products, the sales of calcined gyp-

TABLE 7. LOCATION OF PLANTS IN THE UNITED STATES USING DOMESTIC GYPSUM

States	1920	1921	1922	1923	1924	1925	1926	1927
Iowa	6	6	6	7	6	7	7	7
Kansas	3	3	3	3	3	3	3	3
Michigan	6	5	6	6	8	5	5	6
Nevada	4	4	5	4	6	6	5	5
New York	8	9	8	8	13	9	11	11
Ohio	3	3	3	3	4	3	3	3
Oklahoma	4	3	5	4	5	4	3	4
Texas	5	4	5	4	7	6	5	4
Utah	*	3	3	3	4	*	3	*
Wyoming	4	5	5	4	3	*	*	*
Other states	18	17	15	16	13	18	14	17
Total	61	62	64	62	72	61	59	60

*Included in "Other States."

TABLE 8. SUMMARY OF BUILDING PERMITS IN THE UNITED STATES FOR THE YEARS 1920-1927* (IN THOUSANDS OF DOLLARS)

Dist.	Group of Cities†	1920	1921	1922	1923	1924	1925	1926	1927
1	New York and northern New Jersey	$369,711	$562,755	$773,747	$977,231	$1,071,288	$1,278,820	$1,317,632	$1,168,161
2	Ill., Ind., Iowa, Wis., Mich., Mo., Kan., Neb., Okla.	295,225	341,117	556,604	726,467	769,645	906,186	894,393	826,340
3	California, Washington and Oregon	168,927	201,989	302,006	408,351	394,940	417,065	359,802	329,098
4	Eastern Penn., southern N. J., Md., Del., D. C., Va.	160,753	143,081	287,528	308,741	334,366	386,637	316,990	259,844
5	Western Penn., W. Va., Ohio and Ky.	167,770	146,805	214,628	243,190	265,343	309,712	273,862	253,640
6	New England	101,449	84,907	152,680	153,719	209,983	251,184	198,844	190,541
7	N. C., S. C., Ga., Fla., Ala., Miss., Tenn., Ark., La.	78,759	79,630	119,858	145,596	176,363	234,617	228,085	156,265
8	Arizona and Texas	48,269	46,830	55,205	64,974	76,869	98,083	94,769	85,278
9	Minn., N. D., S. D., Colo., Utah, Mont., Idaho, Wyo.	53,313	61,638	91,582	112,189	92,891	105,171	74,444	69,355
	Total	$1,444,176	$1,668,752	$2,553,838	$3,140,458	$3,391,688	$3,987,475	$3,758,821	$3,338,522

*From Bulleitn of Portland Cement Association showing values tabulated in detail by cities, based on Bradstreet's and The American Contractor Building statistics. †Years 1920 to 1923, inclusive, represent 180 cities; 1924 to 1927, 210 cities.

sum amounted to 1,304,354 short tons valued at $13,052,296, or 30% of the total quantity and 29% of the total value for the country during 1927. Of the 19 plants in operation during this year in this district, the average daily capacity was 9029 tons, or nearly 30% of the grand total.

DISTRICT 3—For the next largest district (No. 3) comprising California, Washington and Oregon, the value of the building permits issued in 1927 was $329,098,000. This amount represents 10% of the total issued in the United States. California was the only one of these states in which domestic gypsum was calcined, but other plants in California and Washington produced gypsum products from imported Mexican material. The daily capacity of plants in these states constitutes about 2½% of the total for the country. One new plant has started operations in this district since 1927.

DISTRICT 4—The middle Atlantic section, district 4 (comprising eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia and Virginia), is of the few areas that fails to provide the bulk of its supplies of gypsum products from local plants. It ranks fourth in the value of building permits issued, but its gypsum calcining industry is of only minor importance in relation to the size of the industry as a whole. This region, besides being furnished with plaster from the two plants in southwestern Virginia using domestic gypsum and the plant at Chester, Penn., using imported Canadian rock, relies to a great extent upon water-borne shipments from the plants in the vicinity of New York City. Gypsum plants in western New York and north-central Ohio also ship considerable quantities of gypsum products into this area, and, in fact, plants as far west as Iowa and Kansas find considerable sale for their products in this market. The value of the building permits issued in this district in 1927 was a little less than 8% of the total for the United States, the figures amounting to $259,844,000 out of a total of $3,338,522,000.

The daily capacity of the plants in this district is estimated at 2415 short tons or 8% of the plant capacity of the United States as a whole.

DISTRICT 5—The fifth district, on the other hand, manufactures sufficient gypsum products for its own needs. In 1927 this territory, which comprises western Pennsylvania, West Virginia, Ohio and Kentucky, issued building permits to the value of $253,640,000, or 8% of the total, whereas its three plants using domestic gypsum (all located in north-central Ohio) produced and sold in 1927 calcined gypsum amounting to 456,817 short tons and valued at $5,011,118, or 11%, of the quantity and value for the country as a whole. The average daily capacity represents 4% of the total, or 1250 tons. A large part of Ohio's gypsum products is shipped outside the state for consumption, especially to ports along the Great Lakes, in order to take advantage of the cheap water rates contributing to this result.

DISTRICT 6—In the sixth district, which comprises the New England states, there are no plants which use domestic gypsum. This territory is fairly well supplied with calcining and fabricating plants, but these use imported Canadian rock or calcium sulphate waste from the manufacture chemicals.

DISTRICT 8—In 1927 the eighth district, which includes the states of Arizona and Texas, issued building permits to the value of $85,278,000, or 3% of the total, but its six plants, having a daily capacity of 3020 tons,

TABLE 9. CALCINING KETTLES AND KILNS REPORTED BY GYPSUM PRODUCERS IN THE UNITED STATES, 1927, BY DISTRICTS*

	No. of producers and importers	Kettles		Rotary kilns		Total daily capacity short tons
		Number	Daily capacity short tons	Number	Daily capacity short tons	
District 1	15	37	5,840	12	3,820	9,660
District 2	20	71	8,809	2	200	9,029
District 3	4	10	750	....	.....	750
District 4	4	11	2,415	....	.....	2,415
District 6†	8	23	2,617	3	300	2,917
District 7	....	.....	.....	....	.....	.....
District 8	6	42	3,020	....	.....	3,020
District 9	11	24	1,500	....	.....	1,500
Total	71	226	26,201	17	4,320	30,541

*Original producers' schedules. †Includes Nevada and New Mexico.

During 1927 building permits were issued in New England to the value of $190,541,000, or 4% of the total for the United States. During this year the plants in this district imported and sold about 299,901 short tons of calcined gypsum valued at approximately $2,181,553. Since then several new plants have started operations, using Canadian gypsum or calcium sulphate waste.

DISTRICT 7—In the seventh district, which comprises the states of North and South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Arkansas and Louisiana, there were in 1927 no gypsum calcining plants in operation, although one of the large fertilizer companies is reported to have started to erect a gypsum products plant at Tampa, Fla., to utilize waste from the manufacture of phosphoric acid. This entire southeastern part of the United States issued building permits to the value of $156,265,000 in 1927, or a little less than 5% of the total, but it relies entirely for its needs upon gypsum products brought in from other sections of the country.

On the basis of its building operations in 1927, this district should require about 55,000 tons of gypsum products annually. This quantity is now derived approximately as follows: From the New York district (by water to south Atlantic and gulf ports), 15% or 8000 short tons; from southwestern Virginia (by rail), 36% or 20,000 tons; from north-central Ohio (by rail), 7% or 4000 tons; from Michigan and Iowa, 4% or 2500 tons; from Kansas and Oklahoma, 4% or 2500 tons, and from Texas, 33% or 18,000 tons.

DISTRICT 8—In 1927 the eighth district, which includes the states of Arizona and Texas, issued building permits to the value of $85,278,000, or 3% of the total, but its six plants, having a daily capacity of 3020 tons, or 10% of the total, sold only 397,530 tons of calcined gypsum valued at $4,024,713, or less than 1% of the total quantity and about 9% of the total value for the United States. The deficit was made up by shipments from New Mexico, Oklahoma and Kansas, although a small tonnage of gypsum products was also shipped out of Texas, as noted previously.

DISTRICT 9—The ninth district, comprising Minnesota, North and South Dakota, Colorado, Utah, Montana and Idaho, issued building permits in 1927 valued at $69,355,000, or 2% of the United States' total. Eleven plants were in operation during the year, having a daily capacity of 1500 tons or 5% of the total, and selling 100,327 tons of calcined gypsum valued at $756,417 or 2% of the quantity and less than 2% of the total sales in the United States.

The states of Nevada and New Mexico, which are not included in the statistics covering the value of building permits issued in 1927, had six calcining plants using domestic crude gypsum.

Market Analysis

It is common knowledge that much more attention has been given in the past to efficiency of production than to efficiency of market distribution. Production has been studied, labor-saving devices have been invented and mechanical power has largely displaced handwork. As a result, production

TABLE 10. CRUDE AND CALCINED GYPSUM SOLD BY PRODUCERS AND IMPORTERS IN 1927, BY DISTRICTS* (IN SHORT TONS)

	Number of producers or importers	Sold crude		Sold calcined		Total value
		Quantity	Value	Quantity	Value	
District 1	15	370,172	$1,089,579	1,573,910	$17,934,419	$19,023,998
District 2	20	419,091	925,849	1,304,354	13,052,296	13,978,145
District 3	4	68,972	150,362	68,394	376,019	526,381
District 4	4	71,243	302,966	113,773	1,475,146	1,778,112
District 5	3	11,210	30,761	456,817	5,011,118	5,041,879
District 6†	8	66,878	193,031	299,901	2,181,553	2,374,584
District 7‡	....	.....	.....	.....	.....	.....
District 8	6	28,662	57,598	397,530	4,024,713	4,082,311
District 9	11	35,873	94,384	100,327	756,417	850,801
Total	71	1,072,101	$2,844,530	4,315,006	$44,811,681	$47,656,211

*Original producers' schedules. †Includes Nevada and New Mexico. ‡No plants in this district.

costs at the average factory have been satisfactorily reduced. Only comparatively recently, however, has much critical or serious attention been given to the study of market distribution.

At present the location of gypsum products plants with reference to consuming markets necessitates, in some instances, exceptionally long freight hauls. Especially true is this of those districts which have an excess of products above their own requirements and which are therefore compelled to seek markets more or less at a distance.

This condition is the natural result of erecting at the most likely deposits of gypsum, plants that can produce far more than the nearby territory can possibly absorb. Numerous plants, though erected at very good deposits of gypsum, have had to close down indefinitely after operating a year or so at a loss. The records of California and New York especially are filled with such instances. The deposits in these states, be-

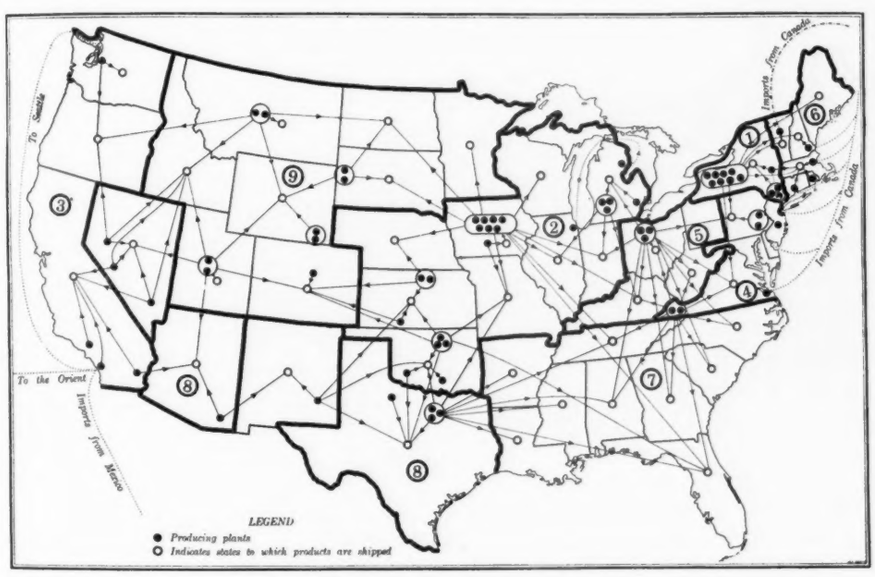


Fig. 4. Market area for gypsum products

ing exceptionally large and numerous, have attracted a generous supply of capital for their exploitation. Gypsum plants erected in the past in Nevada, New Mexico, Colorado and Oklahoma likewise seldom operated more than a year or so before being compelled to close down. Today in these four states there are only 11 plants in operation—an exceptionally small number as compared with the number that have actually been built and operated.

Many other firms throughout the United States have failed because they neglected to analyze the selling possibilities of their product prior to the erection of their plants, because they made a product unsuitable to their markets, or because through using wrong selling policies they were unable to cultivate the potential demand of their markets. A few companies have tried to introduce products with which the local market was not at all familiar, and have not had enough money set aside to carry on the requisite educational advertising campaign. Architects and building contractors are seldom familiar enough with the possibilities and good points of gypsum building materials to advise the prospective builder or home owner what gypsum materials to ask for. In consequence, considerable effort and money have been expended in the past in educating the building supply dealer concerning gypsum building materials, but as gypsum products are only one of a number of building materials handled, the dealers are more inclined to sell the product which has the least selling resistance. On the other hand, through the efforts of the gypsum products salesmen, dealers in building supplies sometimes stock too heavily with products not known in their market area, only to find out too late that they cannot sell them.

In order to have any advantage in railroad freight rates the dealers must purchase their material in carload lots, but they sell to the builder generally in smaller quantities. As a rule their capital is limited and their warehouse space small, but even if they had sufficient capital it would not be a good business policy to keep it tied up for long periods in idle inventories. Moreover, gypsum products, especially plasters, deteriorate with time, and this reason alone forces the smaller supply dealer to purchase in less than carload lots and consequently to pay a higher freight rate. Since many deliveries have to be made in less than carload lots and since occasional delays in transportation are inevitable, it is obviously desirable to have sufficient stocks of goods carried to points near the ultimate consumer so that deliveries can be made cheaply and quickly.

Because of the bulkiness and comparative cheapness of most gypsum building materials it is not economically possible for the smaller manufacturers to maintain their own warehousing facilities always at the most strategic points in their market areas. The larger manufacturers, on the other hand, are able to do this, and consequently they are frequently better able to compete for the business in a given area. One of the larger companies manufacturing gypsum products has its warehouses distributed throughout the United States. In the past several of the larger producers also had their own retail branches, but instead of selling direct to the consumer in competition with dealers that handled their own goods, the manufacturers have finally decided to work only through the regular building-supply houses in each territory. It is now reported that there are no retail branches in existence in the gypsum industry in this country.

Freight Rates

Table 11 gives the freight rates in effect as of March 21, 1929, on the principal gypsum building materials from the important producing points to the main centers of consumption. The map (Fig. 4) shows these points of production and the market that each plant serves.

Practically every plant located in the United States is adequately served by one or more railroads, and many of them are able also to make shipments direct by water. While it is known that the transportation facilities have not kept pace with the expanding area of the markets and the increased quantities of goods to be transported, the motor truck has replaced, to a considerable degree, the railroad in all short-haul shipments; to a certain extent this has allowed the railroads to handle more economically the longer hauls.

The shipments of crude gypsum from Canada to the fabricating plants along the north Atlantic seaboard are all water-borne; one company, at least, owns its own vessels.

Declaring that imports have driven the New York state producers out of the seaboard markets, the domestic gypsum producers in a brief presented in January, 1929, before the ways and means committee, stated:†

> . . . the principal importer from the Canadian fields brings in this partly manufactured material to the producers' principal markets at a cost of $1.15 per short ton. The average cost to the New York state producers of laying down the crushed rock at the same markets is a minimum of $5.30 per short ton. As the manufacturing costs are substantially the same at all points in this country, this differential of $4.15 is maintained on all gypsum products, the difference between $5.30 and $1.15 as above.

Gypsum shipped from the New York state fields in calcined forms costs, delivered to their principal markets, $10.60 per short ton, including sacks. Most of the gypsum shipped is wall plaster and costs the New York pro-

†Tariff Readjustment, 1929, Hearings before the Ways and Means Committee, House of Representatives, 70th Congress, 2d Session, vol. 2, Schedule 2, 1929, p. 1037.

ducers $11.25 per short ton delivered to Newark, N. J., and New York City and $12.05 per short ton at Washington and $12.25 per short ton at Boston and New England points. This includes sacks. Present selling prices, including sacks, at Newark, New York City and Philadelphia are $10.50 per short ton, at Washington $11.80 per short ton and at Boston and New England points $11.50 per short ton. The importers maintain their mills for calcining the Canadian material at Portsmouth, N. H., Boston, New Haven, New York City, Newark, N. J., Philadelphia and Chester, Penn., with plants proposed and projected at other points on the south Atlantic seaboard and on the Gulf of Mexico. Thus they can deliver wall plaster with their existing plants and with those proposed at seaboard points at a cost of not to exceed $6.85 per short ton, including bags.

Foreign competition is likewise a factor on the Pacific coast; plants in California and Washington receive their supplies of crude gypsum from deposits in lower California, Mexico, as the freight rates from Mexico to points along the Pacific coast are much less than from the Rocky Mountain states into the principal consuming markets in California, Oregon and Washington. As noted elsewhere in this paper, several of the districts shown on the map are self-sustaining, other of the districts produce more products than their immediate market can absorb and ship into neighboring states, while certain other districts rely entirely upon shipments from outside.

TABLE 11. SCHEDULE OF FREIGHT RATES ON GYPSUM PRODUCTS[1]

(Cents per 100 lb.)

Dist.	Distribution	Gypsum plaster	Gypsum plaster board	Gypsum wall board	Gypsum blocks	Gypsum building tile
1	Akron, N. Y., to:					
	Boston, Mass.	22½	25	[2] 28½	22½	[3] 28½
	New York, N. Y.	17½	19½	[2] 26½	17½	[3] 26½
	Philadelphia, Penn.	17½	19½	[2] 26½	17½	[3] 26½
	Baltimore, Md.	17½	19½	[2] 26½	17½	[3] 26½
	Albany, N. Y.	14	16	[2] 21½	16	[3] 21½
	Buffalo, N. Y.	7	8	[2] 9	7	[3] 9
2	Ft. Dodge, Ia., to:					
	Minneapolis, Minn.	[4] 14	[4] 14	[2] 21	[5] 15½	[3] 15½
	Milwaukee, Wis.	[6] 14½	[4] 17½	[2] 27½	[5] 20½	[3] 20½
	Chicago, Ill.	[6] 14½	[4] 17½	[2] 27½	[5] 20½	[3] 20½
	St. Louis, Mo.	[4] 18	[7] 18	[2] 29½	[5] 20½	[3] 20½
	Kansas City, Mo.	[4] 12	[4] 12	[2] 26	[5] 17	[3] 17
	Des Moines, Ia.	13½	13½	20½	15	15
	Pierre, S. D.	33½	33½	[2] 50	[5] 34½	[3] 34½
	Bismarck, N. D.	[7] 18	[7] 18	21	15½	15½
		[4] 14	[4] 14	[2] 45½	[5] 30½	[3] 30½
	Medicine Lodge, Kan., to:					
	Los Angeles, Calif.	44½	44½	[2] 135	44½	[3] 110
	Chicago, Ill.	[4] 26½	[4] 26½	[2] 65	[4] 26½	[3] 38
	Denver, Colo.	[8] 56½	[8] 56½	[2] 56½	[5] 44½	[3] 44½
	St. Louis, Mo.	24½	24½	[2] 54	24½	[3] 32
	Memphis, Tenn.	24½	24½	[2] 64	24½	[3] 37
	New Orleans, La.	31½	31½	[2] 71	31½	[3] 42
	Galveston, Tex.	[8] 64	[8] 64	[2] 64	[5] 37	[3] 37
	Omaha, Nebr.	18½	18½	[2] 47	18½	[3] 27
	Grand Rapids, Mich., to:					
	Detroit, Mich.	14	14	[2] 19	10½	10½
	Chicago, Ill.	16	16	[2] 20½	11¼	11¼
	Cleveland, Ohio	17½	17½	[2] 22½	13½	13½
	St. Louis, Mo.	20	20	[2] 27½	17¼	17¼
	Pittsburgh, Penn.	20½	20½	[2] 26½	16½	16½
	Acme, Okla., to:					
	Los Angeles, Calif.	44½	44½	[2] 135	44½	[3] 110
	Chicago, Ill.	24	24	[2] 71	[5] 41	24
	Denver, Colo.	20½	20½	[2] 80	[5] 56½	20½
	St. Louis, Mo.	[4] 17½	[4] 17½	[2] 60	[5] 35	[4] 17½
	Memphis, Tenn.	20½	20½	[2] 57	[5] 33	20½
	New Orleans, La.	[4] 25	[4] 25	[2] 65	[5] 38	[4] 25
	Galveston, Tex.	28	28	[2] 67½	28	[3] 45½
	Omaha, Neb.	[4] 17	[4] 17	[2] 67	[5] 33	[4] 17½
3	Long Beach, Calif., to:					
	Los Angeles, Calif.	4	5	[c]	5	5
	Phoenix, Ariz.	23½	23½	23½	23½	23½
	San Francisco, Calif.	20	20	20	20	20
	San Diego, Calif.	13	13	13	13	13
	Midland, Calif., to:					
	Los Angeles, Calif.	11	11	11	11	11
	Phoenix, Ariz.	19	19	19	19	19
	San Francisco, Calif.	22½	22½	22½	22½	22½
	San Diego, Calif.	16	16	16	16	16
4	Pt. Clinton, Ohio, to:					
	Detroit, Mich.	11½	11½	[2] 15	10½	10½
	Chicago, Ill.	17½	17½	[2] 22½	11¼	11¼
	Cleveland, Ohio	11	11	[2] 14½	13½	13½
	Pittsburgh, Penn.	15½	15½	[2] 21	16½	16½
	Cincinnati, Ohio	14½	14½	[2] 21	14¼	14¼
	Buffalo, N. Y.	15½	15½	[2] 22	15	15¾
	Charleston, W. Va.	16	16	[2] 23	18	18
6	Plasterco, Va., to:					
	Charleston, S. C.	19½	[2] 45	[2] 45	19½	19½
	Savannah, Ga.	19½	[2] 45	[2] 45	19½	19½
	Jacksonville, Fla.	19½	[2] 52	[2] 52	19½	19½
	Wilmington, N. C.	28½	[2] 44	[2] 44	[5] 44	[3] 44
	Atlanta, Ga.	19½	[2] 41	[2] 41	[5] 41	[3] 41
	Richmond, Va.	15½	15½	[4] 36½	15½	15½
	Norfolk, Va.	15½	15½	[2] 46	15½	15½
	Baltimore, Md.	21½	21½	[2] 43	21½	21½
	Charleston, W. Va.	19½	19½	[2] 33½	19½	19½
	Pittsburgh, Penn.	22½	22½	[2] 40	22½	22½
8	Douglas, Ariz., to:					
	Phoenix, Ariz.	18½	18½	18½	25	18½
	El Paso, Tex.	11½	11½	11½	11½	11½
	Denver, Colo.	42	42	42	[5] 84½	[3] 84½
	Deming, N. M.	17½	17½	17½	17½	17½
	El Centro, Calif.	25	25	25	25	25
	Sweetwater, Tex., to:					
	Los Angeles, Calif.	44½	44½	[2] 135	[5] 110	[3] 110
	Chicago, Ill.	30½	30½	[2] 82	[5] 48	[3] 48
	Denver, Colo.	[4] 22½	[4] 22½	[2] 99	22½	67
	St. Louis, Mo.	24½	24½	[2] 71	[5] 41	[3] 41
	Memphis, Tenn.	24½	24½	[2] 64	[5] 37	[3] 37
	New Orleans, La.	[4] 25	[4] 25	[2] 65	[5] 38	[3] 38
	Galveston, Tex.	[8] 58½	[8] 58½	[2] 58½	[5] 41½	[3] 41½
	Omaha, Neb.	24½	24½	[2] 70	[5] 41	[3] 41
9	Loveland, Colo., to:					
	Denver, Colo.	9	9	9	10	9
	Salt Lake City, Utah	[10] 36	[10] 36	[11] 45	48	48
	Omaha, Neb.	20½	20½	20½	26½	41
	Kansas City, Kan.	33	33	40	26½	41
	Portland, Colo., to:					
	Denver, Colo.	[12] 9	9	9	[5] 15½	[3] 15½
	Salt Lake City, Utah	36	[2] 79	[2] 79	[5] 44½	[3] 44½
	Omaha, Neb.	20½	20½	20½	[5] 41	41
	Kansas City, Kan.	[12] 18	18	18	41	41
	Heath, Mont., to:					
	Seattle, Wash.	[13] 25	[13] 25	[13] [14] 25½	[13] [15] 25½	[10] [16] 26½
	Portland, Ore.	[13] 25	[13] 25	[13] [14] 25	[13] [15] 25½	[13] [16] 25½
	Butte, Mont.	[17] 17	[17] 17	[17] 17	[17] 17	[17] 17
	Boise, Idaho	[10] 37	[10] 37	[10] [11] 37	[10] [15] 37	[10] [16] 37
	Piedmont, S. D., to:					
	Omaha, Neb.	[10] 14½	[10] 14½	[10] 14½	[5] 35	[3] 35
	Cheyenne, Wyo.	20½	20½	20½	[5] 37	[3] 37
	Denver, Colo.	20½	20½	20½	[5] 37	[3] 37
	Minneapolis, Minn.	22	22	22	[5] 38½	[3] 38½
	St. Paul, Minn.	22	22	22	[5] 38½	[3] 38½
	Nephi, Utah, to:					
	Denver, Colo.	[8] 106	[2] 106	[2] 106	[5] 51	[3] 51
	Los Angeles, Calif.	25	[2] 49½	49½	49½	49½
	Portland, Ore.	[8] 83	[2] 83	[2] 83	[5] 57	[3] 57
	Seattle, Wash.	[8] 96	[2] 96	[2] 96	[5] 67	[3] 67
	Kane, Wyo., to:					
	Boise, Idaho	103	103	103	[5] 108½	[3] 108½
	Denver, Colo.	[8] 61	[2] 61	[2] 61	[5] 38½	[3] 38½
	Portland, Ore.	[10] 57	[10] 57	81	103	[17] 119½
	Cheyenne, Wyo.	[8] 61	[2] 61	[2] 61	29½	[3] 38½
	Laramie, Wyo., to:					
	Boise, Idaho	[10] 37	[10] 37	[10] [11] 37	99	99
	Denver, Colo.	[18] 9	[18] 9	[11] [18] 9	[18] [19] 13½	[3] 22½
	Portland, Ore.	[13] 33½	[13] 33½	[11] 33½	[5] 103	[17] 119½
	Cheyenne, Wyo.	[18] 9	[18] 9	[11] [18] 9	[18] [19] 13½	[3] 11½
	Acme, N. M., to: [20]					
	Topeka, Kan.	18½	18½	18½	18½	18½
	Kansas City, Kan.	18½	18½	18½	18½	18½
	Wichita, Kan.	18½	18½	18½	18½	18½
	Oklahoma City, Okla.	18½	18½	18½	18½	18½
	Fort Worth, Tex.	29½	29½	29½	29½	29½
	Dallas, Tex.	29½	29½	29½	29½	29½
	Austin, Tex.	29½	29½	29½	29½	29½
	Denver, Colo.	26½	26½	26½	26½	26½
	El Paso, Tex.	17½	17½	17½	17½	17½
	Arden, Nev., to: [16]					
	Sacramento, Calif.	25	25	25	25	25
	Los Angeles, Calif.	13½	13½	13½	13½	13½
	Reno, Nev.	54	54	54	44½	44½
	Salt Lake City, Utah	31	31	31	31	31
	Ludwig, Nev., to: [16]					
	Sacramento, Calif.	15½	15½	15½	15½	15½
	Los Angeles, Calif.	25	25	25	25	25
	Reno, Nev.	11	11	11	11	11
	Salt Lake City, Utah	20	20	20	20	20

NOTES

[1] As compiled by Interstate Commerce Commission as of March 21, 1929.

[2] Class rate per rating on:
"Boards—
Wall:
Plaster boards (fibre-board, pulp-board, straw-board, felt or fibre and plaster combined)."

[3] Class rate per rating on "Tile, building, hollow."

[4] Maximum weight 60,000 lb.

[5] Class rate per rating on artificial stone building blocks, not in imitation of chiseled, dressed, hammered, or sand-rubbed natural stone.

[6] Maximum weight 80,000 lb.

[7] Maximum weight 40,000 lb.

[8] Class rate on "Plaster, wall minimum weight 40,000 lb., and board-plaster, minimum weight 36,000 lb."

[9] Class rate per Virginia classification on "Plaster Boards."

[10] Minimum weight 60,000 lb.

[11] Minimum weight 50,000 lb.

[12] Commodity rate on wall plaster.

[13] Minimum weight 80,000 lb.

[14] Commodity rate on plaster board.

[15] Commodity rate on plaster blocks.

[16] Commodity rate on plaster tile.

[17] Minimum weight 40,000 lb.

[18] Minimum weight 30,000 lb.

[19] Commodity rate on cement plaster blocks.

[20] Not included in the compilation showing value of building permits issued.

Phosphate-Rock Industry in 1928 As Compared With 1927*

By Bertrand L. Johnson
Associate Scientist, U. S. Bureau of Mines

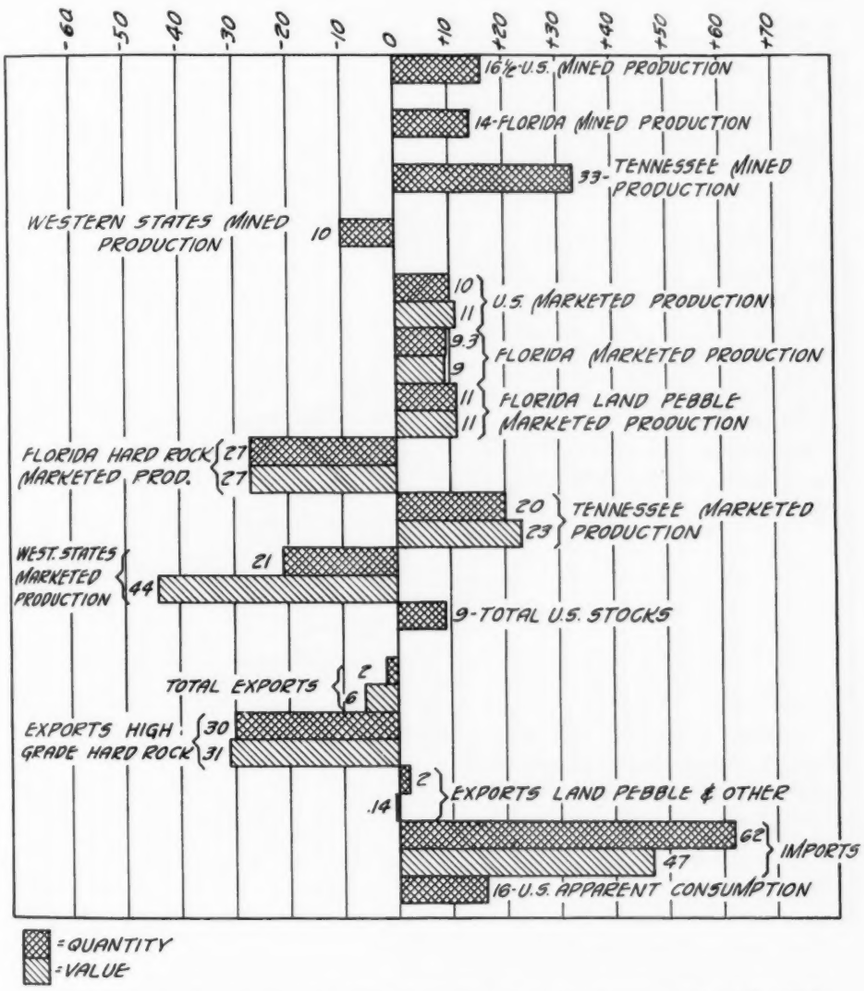
THE PHOSPHATE-ROCK INDUSTRY of the United States markets its product both at home and abroad. In recent years there has been a general upward trend in the demand for the American rock in both markets, the demand in the domestic market increasing at the greater rate. The year 1928 saw a continuation of the upward trend of the demand in the domestic market, but a slight reaction in the foreign demand.

In the domestic market the increased demand was for those types of eastern phosphate rock customarily sold in that market with a lessened demand for western rock. To meet this increased demand greater quantities of phosphate rock were mined and marketed in the Florida land-pebble area and the Tennessee phosphate-rock fields in 1928 than in 1927. The lessened demand for western rock showed in the marked declines both in mined and marketed production in the fields of the western states. The declining foreign demand for Florida hard-rock phosphate resulted in a greatly decreased production of that type of rock. In spite of this decrease, however, the total quantities of phosphate rock both mined and marketed in the United States exceeded those of the previous year. The increased activity in mining operations resulted in a slight excess of mined over marketed production, with a consequent incerase in the stocks of phosphate rock in the hands of the producers at the end of the year.

Conditions in the export market were unfavorable. A slight decrease in the quantity of phosphate rock exported was accompanied by a greater decrease in the total value of the exports. These declines were due to the large decrease both in the quantity and total value of the exports of Florida hard-rock phosphate. There was a very slight decrease in the total value of the Florida land-pebble shipments, although the quantity of that commodity exported increased somewhat.

The greatest percentage change in the statistics relating to the domestic phosphate-rock industry occurred in the case of imports of crude phosphate rock, which increased markedly in quantity and total value.

The accompanying diagram compares the percentage changes in 1928 with the preceding year as outlined above.



Percentage changes in rock phosphate industry, 1928 compared with 1927

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Florida Phosphate Producers Protest Moroccan Imports

THE phosphate industry of Florida with a capital investment of $67,000,000 and directly employing 4000 men, is seriously threatened by the importation into the United States of Moroccan phosphate brought into the ports of this country as ballast, states an expert who has made a thorough investigation of the situation.

The danger is immediate, as evidenced by the fact that Moroccan phosphate has already entered this country through the port of Baltimore and has been sold in this country at prices below American costs. Moroccan phosphate is produced by cheap labor at wages from 26 to 32 cents per day. It is produced under government subsidy and tax exemption and is transported from the mines by government owned railroads and handled through government owned port facilities.

The managers of the phosphate companies operating in Mulberry, Fla., section recently met with the Lakeland Chamber of Commerce to suggest aid which might be given the industry by the Lakeland chamber.—*Jacksonville* (Fla.) *Times Union.*

On February 9, 1928, the secretary of the treasury said: "After due investigation, I find that phosphate rock from Morocco is being sold in the United States at less than its fair value, and that the industry of mining and selling phosphate rock in the United States has been and is likely to be injured by reason of the importation of phosphate rock into the United States from Morocco."—Editor's Note.

Geology of Southwestern Arkansas

THE GENERAL character of the formations of southwestern Arkansas are dealt with in a recent report, "Upper Cretaceous Formations of Southern Arkansas," brought out by the Arkansas Geological Survey, Little Rock, Ark. Information given therein is useful for an understanding of the economic possibilities of the area.

Putting Over Agricultural Lime*

Specific Suggestions for Lime Manufacturers to Increase Their Sales

By E. O. Fippin

1. Has the agricultural lime industry a sound practical basis?

It has. The value of lime as a profitable improver of crop yields is more widely demonstrated by practical farm experience and by experimental results than ever before. In addition to its direct value to increase crop yields, the value of lime as an important animal nutrition element, to be supplied to the animal through the soil and the crop, is being demonstrated over widening areas. The new knowledge of vitamines and of violet rays as factors in the availability of lime have not discounted the fact of the basic necessity of lime, in proper quantities, in the soil and in the crop, for proper animal nutrition, including human nutrition. The old contentions over the damaging effects to soil organic matter of hydrate and oxide forms of lime have been allayed by the scientific and practical evidence of their unsoundness. The importance of fineness of liming materials in the soil, especially as applied to carbonates, is more clearly recognized than ever before. Incidentally, the old idea of a conflict of interest between the use of lime and fertilizers is now largely wiped out and these materials are seen to supplement each other.

In other words, science and practice maintain a sound foundation under the business of selling lime to the farmer for his soil for the vast majority of the farm area and for many of the key crops in the rotation—the legumes especially.

While there are, and probably for a long time will be, many scientific questions connected with the use of lime calling for deep research and experimentation, I think it may be said that the outcome of these do not vitiate the practical advantage of using recognized forms of lime on the soil in moderate quantity.

2. Are the problems of the larger use of lime on the soil scientific problems of need, form and amount, or of education and sales?

I think the problems of education of the farmer and practical sale of lime to him, are now the real problems of the industry.

Education of the farmer in the use of lime is the joint job of the agricultural extension forces and of the lime manufacturer and dealer. There are some elements of the job that are the peculiar responsibility of each group.

*Talk given at the Third Annual Conference of New England Lime and Limestone Manufacturers and Their Agents, Storrs, Conn., July 16, 1929.

E. O. Fippin

Editor's Note

THIS is one of the seasons of the year when agricultural lime and limestone should move. In spite of much popular agitation to the contrary, this has been a pretty fair year for the farmers. They ought to have money to buy with.

This article is one of the few we have ever seen which attempts to give really specific directions for getting orders from farmers for agricultural lime and limestone.

The author needs no introduction to ROCK PRODUCTS readers. He is now the secretary of the State Conservation and Development Commission of Virginia, and his previous experience peculiarly fits him to discuss the agricultural lime.

He was formerly professor of soil technology at the New York State College of Agriculture, Cornell University, and after that the head of the agricultural department of the National Lime Association, and for two years secretary and general manager of the association. Therefore he not only speaks with authority but sympathetically and understandingly of the producers' viewpoint.

—The Editor.

The extension teacher is "a friend of the court," that is, he is a part of the farmer's own family whose advice the farmer may be expected to take more freely than he will take the advice of the selfishly interested lime dealer and manufacturer. Even at that, the son often finds difficulty in converting his father to a particular course, or the friend to convince his pal. Hence even the extension man feels his limitations in educating the farmer to the point of action on this matter of using lime.

Our agricultural system is building up the extension teacher to effectively take to the farmer, in terms of his own practical situation and individual farm condition, the results of research, experimentation, and general experience, calculated to be profitable on that man's farm. This is being done by field demonstrators, by illustrated talks and soil acidity tests, perhaps with a specially equipped soil fertility automobile, as used in Ohio. If I may add a suggestion it is that the extension forces need to continually re-examine their methods to determine if they are keeping before the farmers of a community, a county, or a state in direct, visual form, the proofs of the crop yield and money value of lime along with that of fertilizers and other means of increasing crop yield. This means carefully worked out, graphic charts, and well illustrated reading material to supplement the field or lecture hall talk. It includes the agricultural press as well as the college publication, for in these days I believe it is demonstrated that 90% of farmers read some agricultural paper. Each week I look through six agricultrual papers, distributed from Iowa to New York and south to North Carolina, and am impresed with the few items in those papers on lime for the soil.

The Educational Job of the Lime Manufacturer

The educational job of the lime dealer and manufacturer, is to supplement the educational effort of the extension staff in increasing the distribution and reading of the facts of the value and special applications of lime, in the agricultural press and in suitable supplementary printing and illustrations. When an experiment, a demonstration or a particular farmer's experience shows the benefits of lime in bigger yield and profit, that is a club to be used repeatedly and with vigor to drive into the mind of that and of other farmers under similar conditions, the idea of using lime. All groups of persons,

whether farmers, or others, present a big sales resistance. Disconcerting as it often is to us, the human mind is a very dense, slow-moving and oft-resting organism. We often marvel at the number of repeated blows from reasonable facts, demonstrated value, and nearby experience, necessary to drive the individual to accept a new idea to the point of practice by himself. We must therefore expect to keep pounding away, and eternally repeating the evidence and carrying the proposed line of action to the last special detail.

The lime dealer or manufacturer, therefore, cannot expect to depend on the work of the extension staff alone and should hump himself to get his product closer to that farmer. As an individual sales matter, the name, the product, the agent and the order from the particular manufacturer should be kept under the nose of the farmer so that it will be easier for him to order and use lime than to forget it. The use of lime even after he is mentally open to it, must be easy, for it takes a lot of positive pressure and initiative for a diffident, uncertain farmer to go out and find out which dealer has lime, and which form he can get conveniently, and at a price he is willing to pay and to make up the order and send it off perhaps with the cash.

Just put yourself in the other fellow's position and consider how frequently you fail to act, even after you are convinced of the wisdom of a course, by these uncertain final details. You want a pair of socks or a new auto or a life insurance policy, but how often do you neglect the purchase until you run into a store, or get a mail solicitation, or an agent corners you and gets your name on the dotted line? For myself I take my cue from my own inclination.

My suggestion, therefore, is that the purchase and use of lime need to be made easier to the farmer just as far as possible.

3. *What steps can the lime dealer or manufacturer take to get closer to the farmer's order for lime?*

(1) He should have some simple, clear literature of his own about his product, its character, strength, chemical form, physical features and suggested use, with some concrete examples by picture or diagram, of crop increases from its uses. Too much of this literature is cheap, poorly prepared, confusing and often bears the stamp of personal bias. That is why so much advertising matter is discounted by the reader. On its face it is open to doubt. Such literature must not only make a pleasing appeal, it must tell a clear, honest story.

(2) It should be easy for the farmer to learn the cost to his station, the address of the nearest manufacturing station where he can get the product, the terms of sale and an order form.

(3) Paid advertising in the press has its serious limitations as to cost and effectiveness. Just what is the optimum of that kind of space for each product I am not prepared to say.

(4) Direct mailing and a periodical use of attention-getting posters, calenders and cards have appealed to me as perhaps the greatest need of the lime industry in getting orders for its product. I am thinking of the matter of economy and the chance of reaching the interested man.

My thought is for each manufacturer, over the territory he presumes to cover, to use a simple return postcard with a brief reminder of the product, suggestion for its use at that season, name of the agent, or manufacturer, and the return card to indicate an order or a call for designated information. This return card should be returned under the postal regulation which permits the first sender to pay the postage on only those cards actually returned. The simple matter of the lack of postage stamp will often prevent action and to no class does this apply more than to the farmer. These cards should be sent out two or three times a year.

4. *Are there any serious practical problems involved in carrying out a direct mail system of advertising and easy order giving and getting?*

Yes, I see two problems for the lime manufacturer:

(1) He must compile and keep revised a mailing list of farmers and keep in hand the machinery for sending out his cards and for following up the returns. That is a sales organization job, prone to be neglected. Not all, but a good fair sprinkling of farmers of the sales territory, should be on this list and I would suggest a card index of those names to make the list flexible and with information about that man accumulating on that card.

(2) Some one must prepare snappy, pointed, seasonable material to go on those mailing cards. Very often the sales force of the dealer or manufacturer is not qualified to put this material in shape. Here is where the associated efforts of the lime manufacturers come into play. I have always believed in the commodity trade association in which many things can be done for the manufacturers as a group that they, as individuals, cannot do for themselves because of the overhead cost.

The association staff should be prepared not only to promote research, gather experimental data and do miscellaneous educational work, but it should co-operate with individual manufacturers in getting up the kind of stories needed for these direct mailing cards. The agricultural lime bulletins formerly issued by the National Lime Manufacturers' Association were designed to approach as closely as conditions would then permit to this kind of information. Of course one man for the United States cannot perform that function for the manufacturers of the country. I am remembering the valuable work done in this direction by Mr. Slipher, Mr. Owens and Mr. Parker in this field for the association. It is a question of co-operative service. Many problems of handling, printing and mailing lists will arise in practice.

5. *Is the problem of cost of such a direct mail system prohibitive?*

I consider that the cost of a reasonable and properly organized development of this direct mail system is not prohibitive. It is a question whether the manufacturer is going to push his business or sit still and take just what comes to him. If he is going to push much or little this seems to me to be the direction for his efforts.

In the agricultural field there is this sharp difference from lime in the construction and chemical fields. There, lime is a rather staple commodity of rather fixed demand which advertising can increase to a very limited degree, or only slowly.

No one questions the potential market for agricultural lime in comparison with present use. The question is, can you sell the market? My suggestions are aimed at means of selling that market. If personal salesmen to call on each farmer are out of the question except in a very limited way, as I think they are, and if general advertising has serious limitations, then this direct mail method is the only recourse. I am assuming the manufacturer will have a reasonable number of well placed agents to supplement his other efforts.

6. *Are there any other practical helps to the farmer in getting and using lime with ease?*

There are in special cases but generalization is perhaps dangerous. The car-door salesman, the lime storage bin and the function of the agent, standard bases of price, form of package or shipment, type and availability of distributing machinery and possibilities of direct-to-the-farm truck delivery in view of modern good roads, are all matters worthy of study in particular cases.

7. *Miscellaneous.*

Speaking more particularly to the agricultural group I still feel as I long have felt that the inspection and reports upon liming materials expressed in the lime inspection laws of the several states are in general very unscientific and calculated to confuse the reader. If available calcium or calcium with magnesium in particular combinations are the real constituents we want the farmer to use we ought to have our inspection data in that form. If fineness is a factor then the reader should get basic information on fineness. These are scientific facts that do not change from state line to state line.

Whatever is right for one state is likely to be right for another. I have long felt that our state agencies, the agricultural chemists and the control officials and the extension staffs of the several states should get together on these matters not only for lime but also for fertilizer constituents, and present basic facts in a uniform manner. The present diversity is, of course, an expression of limited, and therefore diverse, scientific outlook. The important point is that these data often confuse the farmer and are a direct hindrance to his use of liming materials. If he attempts to compare the data from different state reports his confusion is increased. Anything whatever that adds a difficulty of mental grasp or of free, direct action, limits the ultimate result. I am speaking not with any particular state in mind, but with the one thought of how to promote the larger use of agricultural liming material.

We also recognize that the level of prices of agricultural products is another big factor in the use of lime as well as fertilizer. In so far as the use of those materials will reduce the unit cost of production by moderately increasing yields, we can push for that use. As the level of prices of farm products rises—if, and when they do rise, which seems a little remote—then we may count on the use of these materials to automatically increase. We need remind ourselves that progress is being made in the use of soil improving materials.

Sales and Distribution of Lime in 1928

THE LIME SOLD by producers in the United States in 1928 amounted to 4,458,412 short tons, valued at $36,449,635, according to figures obtained from a compilation of reports made by lime manufacturers to the United States Bureau of Mines, Department of Commerce, in co-operation with the Geological Surveys of Alabama, Florida, Georgia, Illinois, Iowa, Kansas, Maryland, Michigan, Missouri, New Jersey, New York, North Carolina, Oklahoma, Texas, Virginia, Washington and Wisconsin. This represents an increase of about 1% in quantity and a decrease of 6% in value as compared with 1927. Sales of hydrated lime, which are included in these figures, amounted to 1,612,818 tons, valued at $13,540,215, an increase of 1% in quantity and a decrease in value of 7%. The average unit value of all lime showed a decrease from $8.75 a ton in 1927 to $8.18 in 1928, and that of hydrated lime a decrease from $9.13 a ton in 1927 to $8.40 a ton in 1928.

Sales of lime used in the manufacture of chemicals—2,138,037 tons, valued at $16,455,657—increased 10% in quantity; lime sold for construction—1,986,465 tons, valued at $17,706,420—decreased 7.5% in quantity; and that sold for agricultural purposes—333,910 tons, valued at $2,287,558—increased 3% in quantity. The table below shows sales of lime by uses in 1927 and 1928.

Ohio, the largest producing state (1,013,676 tons, valued at $8,919,596 in 1928), showed an increase of 2.6% in quantity reported, and Pennsylvania (834,050 tons, valued at $6,119,036 in 1928), increased 2.5% in quantity over 1927. The total number of plants that reported operations in 1928 was 411, six less than in 1927. Although lime-manufacturing plants are distributed throughout the United States, there is much interstate shipment, and the table below shows the shipments of lime in 1927 and 1928 by approximate freight-rate zones.

Of the hydrated lime sold by producers in the United States in 1928, Ohio produced 674,644 short tons (4% less than in 1927). Of this, 642,144 short tons (95%) was sold for construction and was widely distributed throughout the continental United States. The table below shows tonnage distribution, as reported to the Bureau of Mines, presented for blocks of contiguous states roughly comprising various freight-rate zones for 1927 and 1928.

Extraction of Potash from Wyoming Leucite

AS PART of a general program concerning the extraction of potash from a variety of raw materials, such as Texas polyhalite and New Jersey greensands, the Nonmetallic Minerals Experiment Station of the United States Bureau of Mines, Department of Commerce, in co-operation with Rutgers University at New Brunswick, New Jersey, has started some research on the extraction of potash from Wyoming leucite. This material is a potash-bearing silicate which is readily attacked by acids, which dissolve the potash and alumina leaving a siliceous skeleton of the original mineral. Another process depends upon the digestion of leucite with alkalies under pressure.

An economic analysis of various proposed methods for the extraction of potash from leucite has been started. From the cost of the raw materials required, and the estimated return from the sale of the products, the maximum amount of money available for treatment, overhead, freight, profit, etc., is being determined.

LIME SOLD BY PRODUCERS IN THE UNITED STATES, 1927 AND 1928, BY USES

Use	Short tons—1927	—Value	Short tons—1928	—Value
Agricultural	322,893	$ 2,237,871	333,910	$ 2,287,558
Building	2,148,840	20,962,759	1,986,465	17,706,420
Chemical:				
Glass works	78,994	665,026	76,161	588,305
Metallurgy	406,063	2,640,658	504,248	3,055,081
Paper mills	429,606	3,413,030	429,334	3,260,733
Refractory lime (dead-burned dolomite)	374,415	3,459,803	448,761	4,283,036
Sugar refineries	16,086	235,555	22,678	280,186
Tanneries	63,666	501,442	64,464	494,983
Other uses	574,369	4,522,269	592,391	4,493,333
Total chemical	1,943,199	$15,437,783	2,138,037	$16,455,657
	4,414,932	$38,638,413	4,458,412	$36,449,635
Hydrated lime (included in above totals)	1,596,906	14,581,695	1,612,818	13,540,215

LIME SHIPPED IN THE UNITED STATES, 1927-28, BY DESTINATIONS, IN SHORT TONS

Destination	1927 Hydrated lime	1927 Quick-lime	1927 Total	1928 Hydrated lime	1928 Quick-lime	1928 Total
Illinois, Indiana, Michigan, Ohio	443,670	650,163	1,093,833	417,086	663,407	1,080,493
Del., D. C., Md., N. J., N. Y., Penn., W. Va.	649,564	1,036,069	1,685,633	647,443	1,051,076	1,698,519
Conn., Me., Mass., N. H., R. I., Vt.	73,046	219,818	292,864	77,749	202,890	280,639
Fla., Ga., N. C., S. C., Va.	140,001	125,452	265,453	145,884	124,178	270,062
Ala., Ky., La., Miss., Tenn.	75,911	264,208	340,119	92,607	264,494	357,101
Ark., Ia., Kan., Minn., Mo., Neb., Okla., Tex., Wis.	157,794	300,541	458,335	165,016	321,596	486,612
Ariz., Calif., Colo., Idaho, Mont., Nev., New Mex., N. D., Ore., S. D., Utah, Wash., Wyo.	46,837	207,506	254,343	54,085	200,006	254,091
Undistributed and exports	10,083	14,269	24,352	12,948	17,947	30,895
	1,596,906	2,818,026	4,414,932	1,612,818	2,845,594	4,458,412

SHIPMENTS OF HYDRATED LIME FROM PLANTS IN THE UNITED STATES AND IN OHIO, 1927-1928, BY DESTINATIONS

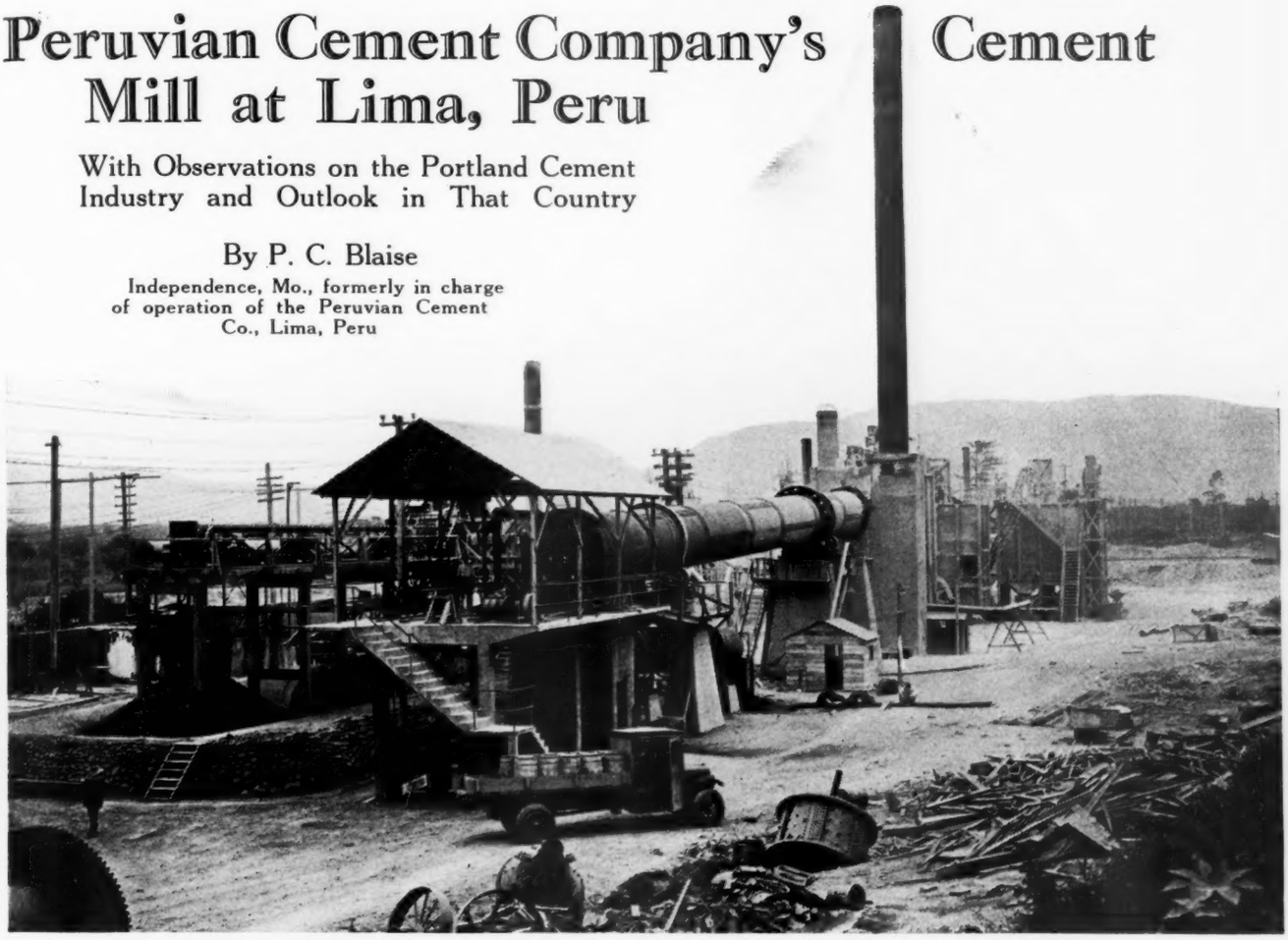
	From all plants— Short tons	Distribution	From Ohio plants— Short tons	Distribution	Group total
Destination—1927:					
Illinois, Indiana, Michigan, Ohio	443,670	27.8%	338,469	48.2%	76.3%
Del., D. C., Md., N. J., N. Y., Penn., W. Va.	649,564	40.7	252,455	35.9	38.9
Conn., Me., Mass., N. H., R. I., Vt.	73,046	4.6	22,046	3.1	30.2
Fla., Ga., N. C., S. C., Va.	140,001	8.8	35,642	5.1	25.5
Ala., Ky., La., Miss., Tenn.	75,911	4.7	20,244	2.9	26.7
Ark., Ia., Kan., Minn., Mo., Neb., Okla., Tex., Wis.	157,794	9.9	28,016	4.0	17.8
Ariz., Calif., Colo., Idaho, Mont., Nev., New Mex., N. D., Ore., S. D., Utah, Wash., Wyo.	46,837	2.9	2,031	0.3	4.3
Undistributed and exports	10,083	0.6	3,343	0.5	33.2
	1,596,906	100.0%	702,246	100.0%	44.0%
Destination—1928:					
Illinois, Indiana, Michigan, Ohio	417,086	25.9%	306,733	45.5%	73.5%
Del., D. C., Md., N. J., N. Y., Penn., W. Va.	647,443	40.1	249,683	37.0	38.6
Conn., Me., Mass., N. H., R. I., Vt.	77,749	4.8	25,582	3.8	32.9
Fla., Ga., N. C., S. C., Va.	145,884	9.1	35,083	5.2	24.0
Ala., Ky., La., Miss., Tenn.	92,607	5.7	19,983	3.0	21.6
Ark., Ia., Kan., Minn., Mo., Neb., Okla., Tex., Wis.	165,016	10.2	30,708	4.5	18.6
Ariz., Calif., Colo., Idaho, Mont., Nev., New Mex., N. D., Ore., S. D., Utah, Wash., Wyo.	54,085	3.4	2,961	0.4	5.5
Undistributed and exports	12,948	0.8	3,911	0.6	30.2
	1,612,818	100.0%	674,644	100.0%	41.8%

Peruvian Cement Company's Mill at Lima, Peru

With Observations on the Portland Cement Industry and Outlook in That Country

By P. C. Blaise

Independence, Mo., formerly in charge of operation of the Peruvian Cement Co., Lima, Peru



The single 125 ft. by 7 ft. 6 in. kiln and cooler at the Peruvian Cement Co.'s plant, Lima, Peru

THE COMPANIA PERUANO DE CEMENTO PORTLAND, located in the outskirts of the ancient city of Lima, Peru, and manufacturing a portland cement under the name of "SOL," was conceived and originally built by a group of far-sighted Peruvian business men, some 14 or 15 years ago. After many trials and tribulations, due to various causes and reasons, it has now evolved itself into an institution which compares not unfavorably to a great many of our smaller plants in the United States.

Located as it is in one of the oldest cities in the Western Hemisphere and on the banks of the famed Rimac River, this institution of modern industry makes a very remarkable contrast to some of its picturesque surroundings. Some of these surroundings have stood since the time of the pleasure-loving Spanish viceroys, who cavorted and commanded until the native Peruvians asserted their independence, threw off the yoke of the Spanish government, and took the country for their own people as a republic.

The organization now exists as one of the largest industries in Peru, being an independent 6,000,000 sole stock company, which represents about $2,400,000 in United States money. The greater part of this stock is owned locally in the city of Lima, being distributed throughout the stock-buying public to a considerable extent.

At the time of its origin very little was known about the use of portland cement or about its manufacture, either by the producers or by the contracting and consuming public. Local contractors and smaller users were skeptical as to whether it was possible to produce a satisfactory cement, with the ultimate result that a very difficult period was experienced. However, directly after the world war matters began to change. An important construction company from the United States had secured a number of big contracts in Peru calling for the use of large quantities of portland cement, and in casting about for suitable locally made materials investigated the plant of the Compania Peruano de Cemento Portland and discovered that a very high grade product could be made, that would more than answer their requirements.

With this as a basis to work upon, arrangements were then made with the local owners of the cement company whereby the United States construction firm was to manage the operation of the plant on a percentage of profit basis. From that time on the plant has rapidly progressed, being enlarged from time to time, until it has reached its present proportions and can consistently produce 1600 bbl. of portland cement each day the year around. Also, the quality has created such a demand, at a price so much lower than the imported product, that importations of cement into the country have decreased to the point where they are practically negligible.

The climate of the country of Peru is all in favor for good cement operation, being very similar to our climate in California, with the one exception that it never rains. All-year-around construction is possible, which naturally calls for all-year operation of any plant that happens to be located in the country. This eliminates costly winter shutdowns due to seasonal markets and assists in lowering the ever fearsome per-barrel cost figure.

The rock used for the manufacture of the cement is situated outside of Lima, about 25 kilometers from the plant, in the lower coastal foothills of the Andes mountains. A sufficient abundance of this material is now owned by the company to insure continuance of operation, at the present production rate, for a period of at least 200

years. The deposit stands adjacent to a government narrow-gage railroad, which runs from the small settlement of Lurin to Lima. This railroad is used for the transportation of the rock, and as freight revenue derived from this source is the chief income of the small railroad, every effort is made to insure prompt and satisfactory service, with the result that it has not been necessary for the company to invest in rock transportation equipment.

The deposit of rock is worked from an open face, averaging about 150 ft. in height and is increasing in height continually, due to the fact that the opening was made in the side of a hill and the work is proceeding towards the top. The length of the quarry is about 350 ft. and runs in practically a straight line. The rock is a peculiar dark slate color and, when being crushed, has a "rubbery" reaction, not being at all brittle. The method of quarrying used is bench-shooting, in benches of about 25 ft. in height.

The chemical composition of the rock is particularly adapted to the manufacture of portland cement, in that the analysis is practically, at all times, the same as unburned raw material. In other words, with the exception of rare intervals, it is not necessary to add any corrective material, the process being simply pulverizing and burning the natural rock, with portland cement as the result.

No Clay or Shale in the Locality

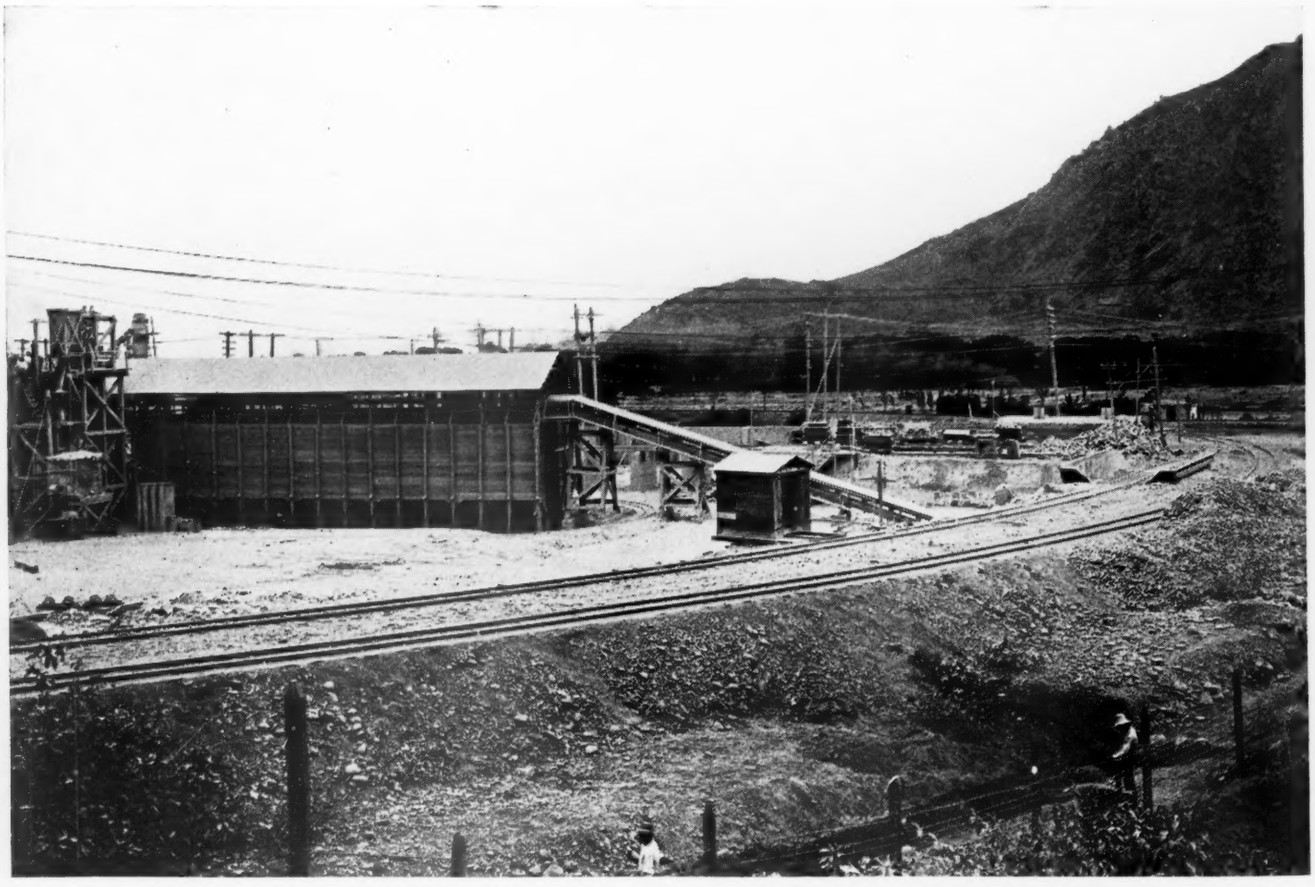
This is extremely fortunate in that, should it be necessary to use clay, shale or some kindred material, it would be impossible to operate the plant, as none is to be had in the vicinity of Lima. That district of Peru is nothing more or less than a sand desert gradually rising into the Andes mountains. There are numerous small hills of a volcanic nature, close by, but none offer the proper corrective material, should any be necessary. The only correction made from time to time is the addition of a small amount of sand to give the mix the proper amount of silica and this addition seldom exceeds 6%.

The rock, after being shot down from the benches to the level floor of the quarry, is hand loaded. The reason that shovel loading has never been inaugurated is due to the cheapness of the labor. The peons in the district around the quarry are willing to work for about the equivalent of $1.20 for a day of eight hours.

After the rock is loaded into the 1-ton, side-dump, steel, Koppel cars it is trammed by the loaders to the lower end of the quarry and dumped directly into two No. 8 McCully, Allis-Chalmers crushers that make the reduction to about 1¼-in. size. These crushers discharge into a 12-in. inclined bucket elevator, the buckets being mounted on rubber belting, furnished by the Jeffrey Manufacturing Co. This discharges into a series of bins that hold approximately 200 tons of the crushed material. The bins are located immediately adjacent to the railroad siding and the rock is discharged directly from them, by means of spouts, into the 20-ton Koppel cars that serve to transport the material to the plant for further processing.

Due to the distance from any source of electrical power and the isolated location of the quarry, no effort has been made to drive the quarry equipment with electric motors. Diesel and semi-Diesel oil-engine units have been provided. The crushers are driven from belts that are connected to two 50-hp. Vickers-Petters, vertical, semi-Diesel engines. These engines also drive, through belts, the counter shafts for the elevating equipment.

The horizontal type ER 8x10-in. Ingersoll-Rand, single-stage compressor, used for furnishing air for drilling, is driven by a horizontal, 25-hp., Campbell, Diesel engine. This unit also serves to drive a small generating set which is used for lighting the quarry face when night work is necessary, and also



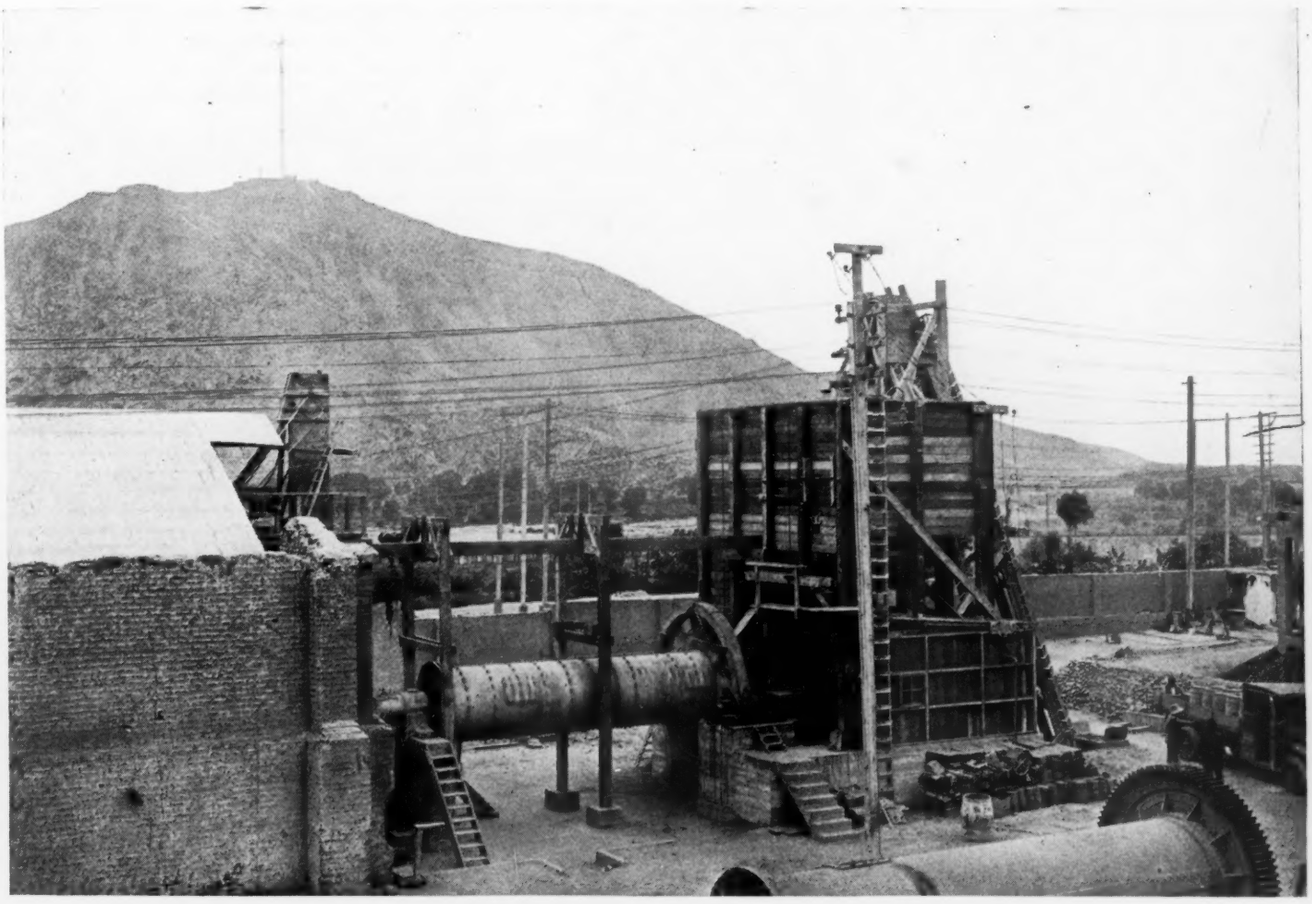
Cars carrying crushed limestone discharge at the receiving hopper (right), from where the stone is carried to storage

is used to light the laborers' quarters. The drilling equipment is all of Ingersoll-Rand manufacture and of various sizes. The larger drills are used for the bench work and the smaller ones on block-holing and so forth.

The problem of water supply proved rather disturbing for quite some period of time, and it was necessary to haul all the water required for the quarry on the backs of burros, in cans. This water was carried for some considerable distance at an extremely high price. Also the delivery was uncertain. However, Providence took a hand and eventually located a spring some 1500 ft. from the quarry, and at an elevation 200 ft. higher. The water is now piped from this spring, which gives more than enough to satisfy the needs of the quarry.

After the rock is transported to the plant in 20-ton steel side-dump cars, manufactured by Koppel, it is first weighed on a Fairbanks-Morse track scale of 40,000-kilogram capacity. The weights are automatically punched on scale tickets, one copy being sent to the railroad from which they issue their invoices and the other retained at the plant for checking. The cars are then drifted down to the unloading hopper by gravity and dumped. In discharging, the rock is allowed to fall into a hopper slightly longer than the car and of an inverted conical shape. This hopper discharges directly to a 16-in. rubber conveyor belt, which is carried on Jeffrey rollers, idlers and standards. This belt, in turn, discharges the rock into a series of five bins, made of timber, that serve as a storage for the crushed stone. The capacity of all these bins is 800 tons. The conveyor is equipped with a Jeffrey automatic traveling tripper, which fills one bin at a time. As the bin is filled, samples are automatically taken and an analysis of the composite sample of this bin is immediately run by the laboratory to ascertain whether it will be necessary to correct the mixture with sand.

When the laboratory issues a release on a bin it is then emptied by discharging by gravity through the bottom on to another 16-in. belt conveyor, identical in its construction with the one used to fill the bins. This conveyor is situated in a tunnel underneath the rock bins and runs the full length of the storage. The gates that feed on to this belt are of the rack-and-pinion, cradle-feeder type; and an even flow is maintained at all times while discharging on the belt. The belt, in turn, discharges into a 10-in. vertical bucket elevator, which empties into another 50-ton bin that feeds directly to two 36-in. Allis-Chalmers crushing rolls. These rolls are connected in closed circuit with each other by means of a Hum-mer electric vibrating screen. The final stage produces a product of ¼-in. maximum size. These rolls discharge into a vertical elevator that feeds another bin, which discharges into a set of hand-operated Allis-Chalmers hopper scales. It is at this point that the correction is made by the addition of a small amount of sand, in case it is necessary.



Raw grinding mills are fed limestone and a small amount of sand from the wooden feed bins

This sand is obtained from alongside the ralroad track that transports the rock, and is loaded into cars, hauled to the plant, unloaded by hand and then ground until about 70% of it passes a 200-mesh screen. This pulverizing is accomplished by a 5x20-ft. Krupp tube mill. The sand is stored in a bin alongside of the hopper scale and is added in proper quantities when so designated by the chemist.

The scale discharges into an 8-in. inclined elevator that deposits the mix into the raw grinding feed bins, which in turn discharge directly into the two raw grinding units.

The raw grinding units consist of two Allis-Chalmbers "Compeb" mills; one mill is a No. 724, driven by a 400-hp. Allis-Chalmers synchronous motor, direct-connected through cut-tooth gears, and a 60-in. Cutler-Hammer magnetic clutch; the other mill is a No. 525, driven by a 200-hp. Allis-Chalmers, synchronous motor, direct-connected

through cut-tooth gears, and a 48-in. Cutler-Hammer magnetic clutch. Each one of the motors has a separate exciting set, direct-driven, in a small room immediately back of the mills and motor switching equipment. The switching equipment and feed controls on the mills are arranged so as to be most accessible to the operator and to enable a constant watch to be maintained at all times. A remote control is also arranged at the discharge end of the mills.

The grinding media used in these mills consist of forged balls, ranging from 2 in. to 5 in. in size, which are used in the preliminary compartment, and 1¼-in. concavex, which are used in the secondary compartment. The mills are so operated that the material is ground to a fineness of 90% passing a 200-mesh screen. This feature is maintained with a rigid inspection by the laboratory at half-hour intervals.

Raw Blending

The raw dust is discharged from the mills through direct spouting into an 8-in. steel-encased, vertical, 8-in. bucket elevator, driven by a 7½-hp. motor. This elevator carries the dust to two large blending bins, in an effort to further make uniform the raw material already well blended by nature. The fact that a very chemically uniform material is arrived at is shown by a typical list of carbonate determinations, shown below. This list represents a 24-hour period, picked at random from laboratory reports:

Hour	$CaCo_3$ Determination	Hour	$CaCo_3$ Determination
1	72.4%	13	72.0%
2	72.8%	14	71.8%
3	72.6%	15	72.6%
4	72.0%	16	72.0%
5	72.4%	17	72.4%
6	72.4%	18	72.0%
7	72.0%	19	72.8%
8	72.2%	20	72.8%
9	72.8%	21	72.4%
10	73.0%	22	72.0%
11	72.4%	23	72.4%
12	72.4%	24	72.8%

The desired percentage was set at 72% for this particular shift of 24 hours.

Kilns—Burning

The burning of the clinker is done in two 8x125-ft. kilns of Allis-Chalmers make, which are driven by 20-hp., Allis-Chalmers variable speed motors, through Allis-Chalmers, Texrope drives. Each kiln has a separate elevator and feeding device, leading from the blending bins. The elevators are driven by General-Electric and Allis-Chalmers, 7½-hp. motors, through gear reducers that are manufactured by the Allis-Chalmers company. The feeders were designed and built in the shops of the plant and consist of a very slow-turning screw conveyor, placed on the bottom side of a triangular-shaped hopper, that extends the full length of the blending bins. In between the hopper and the screw are a series of non-leakable gates, that are set at the proper opening to prevent flooding. There are also small air nozzles in the hopper, which are used to aërate the raw material and insure an even flow of material to the screw. The screw is driven by a 5-hp. General-Electric motor through a Reeves speed regulator, which is controlled from the burning platform.

Every possible facility has been arranged to control the burning and the dust chambers, and the kilns have many connections to determine the gas analysis and temperature, as well as the air flow during the process of calcination. Gas analysis is made from four to five times each day by the laboratory to keep the efficiency in burning high.

The kilns are lined with Harbison-Walker, 6-in. "flint mix" kiln blocks in the burning zone and 4-in. blocks of the same manufacture in the upper end of the kiln. No attempt has been made to use the high alumina blocks as yet, due to the extremely high freight rates, duties and so forth. The average life of the 6-in. liners in the burning zone is from four to six months.

The fuel used in the kilns consists of bunker "C" fuel oil, which is obtained from the International Petroleum Co. This com-

Another view of the plant, showing the various grinding and feeding units, kiln, cooler, etc.

pany owns and operates numerous oil wells in the northern part of Peru, shipping the material to Lima by boat and sending it to the plant in tank cars. This fuel oil has a Baumé scale gravity of 25 to 30 deg. and very consistently carries a B.t.u. content of 18,500, as determined by the Parr calorimeter. Air instead of steam is mixed with the fuel oil on injection into the kiln, through burners which have been changed until they are in reality an original design from the shops in the plant. Waste heat is used to preheat both the oil and the air before entering the burner. A low pressure blower of Connersville make is used to supply the air for mixing with the fuel. The efficiency of the kilns as operated over a six-month period is as follows: The gallons of oil used per barrel were from 7.6 to 8.4, at an average B.t.u. content of 18,720. The production on the kilns was 34.6 bbl. per hour for each kiln, all clinker of good quality.

The kilns discharge into two coolers, one a 5x50-ft. cooler, driven by a 10-hp., Allis-Chalmers motor through a belt drive and gears, and the other a 6x50-ft., manufactured from an old kiln which was the property of the company. These coolers are lined for the first 20 ft. with brick, and for the balance of the distance they are equipped with cast-iron lifters, placed in a staggered position. The coolers are set at a pitch of 3 in. in 1 ft. They discharge directly into an 18-in. Jeffrey Manufacturing Co. apron conveyor, which extends for 35 ft. to a bucket elevator, which in turn deposits the clinker into an automatic scale used for weighing the clinker, and where the gypsum is added. The apron conveyor is driven by a 5-hp. General-Electric motor.

Gypsum is procurable from various deposits near the plant, and is purchased as mine run, shipped to the plant and crushed in a No. 4 Allis-Chalmers McCully crusher, being handled by hand from the crusher to the clinker scales.

Clinker Storage

The clinker is discharged from the automatic scale to a 20-in. Jeffrey pan conveyor, driven by belt on a 5-hp. motor. This pan conveyor operates over the top of one side of the storage, on a concrete trestle, and is equipped with automatic trips at various points. The clinker storage is surrounded by a concrete wall, 18 ft. in height by 240 ft. long by 60 ft. wide. As soon as the clinker is deposited from the pan conveyor it is pulled to various parts of the storage by an Ingersoll-Rand, double-drum, air hoist, equipped with a drag scraper. The inside of the concrete walls of the storage are equipped with permanent cast-iron rings set in the concrete at various intervals and heights. In this way the direction of the scraper can be changed with ease and with a minimum amount of time.

The clinker is drawn from the storage from the bottom into a 14-in. belt conveyor, which runs in a tunnel the full length of the storage. Reclamation of the cold clinker is made by pulling into concrete hoppers with the air hoist and scraper. These hoppers are three in number and have rack-and-pinion gates in the bottom, which discharge on the 14-in. belt. In this way the clinker is well mixed and blended. The 14-in. belt deposits its load in an 8-in. bucket-chain elevator, which discharges into two bins. These bins, in turn, feed into the clinker grinding mills.

Finish Grinding

The clinker grinding department consists of two Allis-Chalmers "Compeb" mills, one a No. 525 and the other a No. 726. The grinding media used in these mills are the same as in the raw department, namely, 2-in. and 5-in. balls in the preliminary compartment, and 1¼-in. "concavex" in the secondary compartment. The fineness of the product of both mills is held to a maximum of 87% passing 200-mesh, and a minimum of 84% passing the same size screen.

The No. 726 "Compeb" is driven by a 450-hp. Allis-Chalmers synchronous motor connected through a 60-in. Cutler-Hammer magnetic clutch. The No. 525 mill is driven by a 200-hp. motor connected through a 50-in. Cutler-Hammer magnetic clutch. The individual switching equipment for both of these mills was furnished by Allis-Chalmers and is of the latest type.

The cement from both of these mills discharges into a 10-in. screw conveyor and into an 8-in. vertical bucket elevator, which, in turn, feeds a 10-in. screw conveyor. This screw conveyor deposits the material in the various bins for the storage. All of this conveying equipment is driven through belts and General-Electric 5- and 7½-hp. motors.

The cement storage is of the old style warehouse construction, although the building of a silo storage is contemplated. It consists of 10 bins, each holding approximately 10,000 bbl. The cement is drawn from these bins with a 10-in. screw conveyor, driven by a 7½-hp. General-Electric motor. This screw conveyor discharges into an 8-in. vertical steel-encased bucket elevator, which deposits the cement into a 150-bbl. bin, above a two-spout Bates valve-bag packer, which is used to pack the cement. The packer is driven by a 20-hp. General-Electric motor.

The American system of cement measure is used; in other words, each sack has a net weight of 94 lb., and there are four sacks to a barrel. Practically *all* of the shipments that leave the plant are truck shipments to the different companies in the city of Lima. For this reason a large quantity of the cement is kept stored in sacks at all times, on a large concrete platform constructed for this purpose, in order to keep rapdily moving the large number of trucks that arrive at the plant each morning. Rail shipments are confined to the railroad which feeds the large holdings of the Cerro de Pasco Copper Co., a large North American copper institution, which is a consistent user of railroad shipments of the Peruvian product.

The power used by the plant is purchased from an Italian-owned power company, which supplies power for the entire city of Lima, as well as operating the electric, street-car service. The power is furnished at the outlet of the power company's substation, where it is metered at 2300 volts. It is conducted from there through a concrete conduit to the cement plant's own sub- and distributing-station, located at a strategic point in the mill in order to economically service the entire mill. The switchboard, transformers and meters are of the latest design, being all newly installed late in 1928. The transformers are placed on a concrete base in the back of the station, with an ingenious method of oil drainage provided for. The switching equipment is divided into two rows, one of which controls all of the 2300-volt equipment and the second controls the lower voltages after the step-down, 550 and 220 being used for the smaller motors and 110 for lighting and laboratory equipment.

Power Distribution

The entire distribution of current is carried out in concrete ducts underground, with leaders rising to the motors in metal, rigid or flexible, conduit. This idea is carried out in full in the substation and plant alike. The switching or metering equipment was furnished by the General Electric Co. Each department in the mill is represented by a single metering panel which carries a recording meter that shows the exact amount used in that particular department, as well as giving the superintendent a check on shutdowns that may otherwise go unreported.

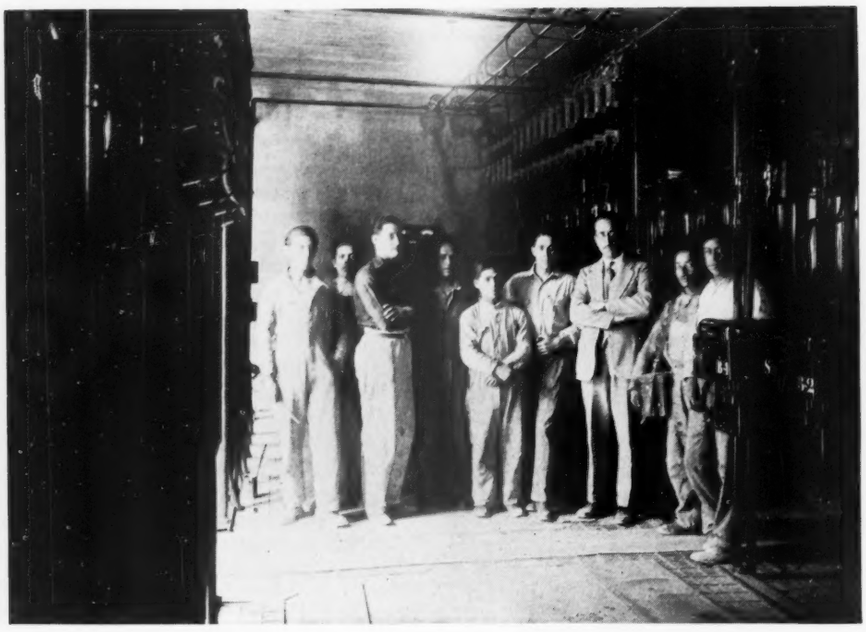
The building itself is of reinforced-concrete construction and houses, as well as the switchboard, the chief electrician's office and also a type 20, 300-cu. ft. vertical, Ingersoll-Rand, direct-connected air compressor, driven by a 60-hp. General Electric motor.

This compressor furnishes the air for operating the air hoists, for shop work and for various other purposes where air is employed in the cement industry.

All the piping for both air and water is carefully laid in concrete ducts, with connection outlets at various points.

The machine-shop equipment consists of the general line of shop machinery, such as 16-in. and 30-in. lathes, shears, punches and so forth. In addition to this is the blacksmith shop, with the power hammer, various forges, and also bronze casting equipment. All of the rough bronze bushings are cast at the plant and turned in the shop.

The storeroom is a newly constructed building and is built along the lines of modern systems. The perpetual inventory system is used to check the large stock that is carried. All of the small equipment is in bins, while the large more bulky material is in racks. The more delicate things, such as electrical and laboratory equipment, are kept in a separate room to avoid damage by handling or by bumping with the heavier material. All of the equipment is kept under lock and key and is requesitioned out.



Interior of the plant's power distributing station, showing the modern switchboard

The company manufactures and prints its own sacks. While it is not commonly known, Peru grows some of the finest cotton in the world, being of extremely long staples and exceptional purity. This cotton is woven into cloth and then purchased by the cement company. Girls are hired on a piece-work basis to cut and sew the sacks. They are then stenciled at the plant. The tying and repairing of the sacks are also done on a contract basis, but the sacks are inspected by the plant officials. The tying is accomplished by Bates bench tiers. All sewing and repairing is done on Singer sewing machines. Cleaning is effected by the means of a "Cedar Rapids" bag wheel, driven by a 3-hp. motor. The discharge from this is screened and used in the plant. A flat charge is made for every sack that is shipped and a refund made on return of the sack, the same as in this country. Paper sacks are being tried out, but the attitude of the trade toward them has not been as yet ascertained.

The laboratory contains much of the modern equipment found in any well-fitted cement laboratory in the United States. All of the equipment was purchased in the United States. "Rotaps" are used for fineness determinations; laboratory pulverizing equipment, such as "Chipmonk" crushers and disc pulverizers, are used in the preparation of rock and clinker samples. Concrete test briquette tanks have been constructed to house the briquettes which are kept up until a year's time. A concrete moist closet for the pats is in use, and an automatic temperature and heat-recording apparatus is installed in connection with this.

The chemical division contains four analytical chemical balances, muffle furnace, electric ovens, concrete benches for titrating and weighing, portable pyrometers and gas analysis apparatus, and a constant daily check on the kiln operation is kept.

The laboratory, in fact, is so equipped that a rigid supervision is held over the product, to such an extent that the quality of the cement is entirely unquestionable. While the American Society for Testing Materials specifications are used as a basis of manufacture, very little attention is paid to them on account of the great superiority the material has to those specifications. Following is a list of the average 7-day and 28-day tensile strengths, which gives an idea of the quality in regard to this one specification. These figures represent pounds per square inch, with a 1:3 mixture, using Ottawa standard sand:

	7-day	28-day		7-day	28-day
1	358	462	16	326	411
2	371	482	17	330	429
3	385	465	18	315	401
4	350	471	19	364	450
5	343	462	20	359	492
6	355	451	21	303	421
7	356	467	22	360	430
8	328	445	23	370	471
9	396	489	24	309	425
10	293	427	25	303	388
11	360	466	26	310	405
12	382	477	27	366	474
13	386	520	28	354	447
14	345	455	29	353	469
15	360	473	30	377	471

A typical chemical analysis of the cement is as follows:

SiO_2	20.17%
Al_2O_3	8.40%
Fe_2O_3	3.71%
CaO	62.62%
MgO	3.26%
SO_3	1.99%
Loss	0.61%

The company is to be congratulated in that it holds such a high standard of quality in its product. Foreign cements, such as Belgian, German, and Danish, sell on the market when there is a shortage of the local product, at approximately an average price of 12.60 soles, or the equivalent of $4.80 gold per bbl. The set price of the Peruvian Cement Co.'s brand is 9 soles net, or the equivalent of $3.60 U. S. gold. With this price differential there might be an incentive to cut quality in order to make more immediate profit, as the local company could easily sell the entire output in any case, since the general mind of the purchaser is the same as of that of the American purchaser a few years ago, namely "Cement's cement."

All native labor is used in the plant. The

Operating and office personnel, Peruvian Cement Co.

peons, very similar to the Mexican peon, are used for common labor. The daily rate of pay in the plant proper ranges from $1.20 U. S. gold to $4.80 gold, for the higher class workmen, such as master mechanics, chief electricians, etc. It is necessary to employ a larger number of men as the amount of work turned out by one of the native peons is small in comparison to what is expected of a laborer in this country. The labor laws of the country are built to the advantage of the laborer. It is very costly to discharge a man who has been with the organization for more than a year; the indemnity sum being equivalent to 90 days of his average daily wage for the previous 90 days. It makes no difference what the infractions of the rules of the company may be. However, with proper treatment there is very little trouble along this line.

Native labor, similar to the Mexican peons, is used at the plant

Many plans are being made for the refinement of the plant, such as the utilization of the waste-heat for power purposes, the possible construction of a direct cableway from the quarry to convey the rock, the installation of a complete dust-collecting system, and many other improvements. The entire plant site is at this moment being paved and before this article is read, undoubtedly, the floor of the complete mill will be of concrete.

One of the unusual things that strikes me in the plant of the Peruvian Company is the fact that all the mills are operating without any covering of any nature. The entire plant is the open air, with the exception of the cement storage, the office and the laboratory. This is made possible by the fact that it never rains in Peru. It is true that fog is constantly prevalent during six months of the year, but it is still possible to operate with the mills, etc., uncovered.

Very little has been known about the cement mills on the West Coast of South America, but they are progressing rapidly, learning by the mistakes of their North American contemporaries. If the present rate of progress is maintained they will soon be equal to the modern mills of North America, and very little foreign cement will be imported into these countries—as the governments are particularly zealous in protecting their national industries.

Talc Sales in 1928

THE TOTAL QUANTITY of talc sold by producers in the United States in 1928 was 202,976 short tons, valued at $2,537,994, according to figures compiled by the United States Bureau of Mines, Department of Commerce, from individual reports furnished by producers. As compared with 1927, these figures represent an increase in quantity of 6% and in value of 14%. The figures comprise 6360 tons of crude talc, valued at $48,031; 936 tons of sawed and manufactured talc, valued at $70,394, and 195,680 tons of ground talc, valued at $2,419,569. There were 20 producers of talc in 1928, the same as in 1927.

Of the total quantity sold, New York supplied 107,321 tons, valued at $1,504,103, as compared with 94,553 tons, valued at $1,191,453, in 1927; Vermont supplied 52,125 tons, valued at $502,501, as compared with 54,688 tons, valued at $503,716, in 1927; and California supplied 17,830 tons, valued at $271,413, as compared with 15,760 tons, valued at $238,755, in 1927. The remainder of the output was produced by Georgia, Maryland, North Carolina, Pennsylvania and Virginia.

Figures for Georgia, Maryland, New York, North Carolina and Virginia were collected in cooperation with the respective state geological surveys.

Imports of talc for consumption in 1928 were 27,049 short tons, valued at $579,915. Corresponding figures for 1927 were 25,194 tons, valued at $550,382.

Helping the Going Concern as Well as the Promoter

A MORE INTIMATE CONTACT among the industrial interests of a community to facilitate the solution of their common manufacturing problems is the object of a study just launched by the department of manfacture of the Chamber of Commerce of the United States.

As a first step, the department has sent out a questionnaire to secretaries of local chambers of commerce to determine to what extent they are already encouraging cooperation among their local manufacturers.

In an accompanying letter, the department points out that most communities, in their desire to acquire new industries, overlook the important fact that industrial expansion comes largely from within and that prosperous industries attract others to a community. Consequently, everything possible should be done to strengthen those industries already established in the community.

One of the most effective ways in which to do this, the department suggests, is to bring the industrial talents of the community together and pool them for the joint benefit of all. In this way, local manufacturers are able to exchange experiences concerning such problems as obsolescence in plant construction, machinery and equipment, and general management, and the like. Also, by this collective co-operation almost any natural handicap of location, transportation, special ordinance and street traffic could be dealt with more effectively.

The department will analyze all information gathered and make it available to chamber members.

Production of Asbestos in 1928

THE TOTAL quantity of asbestos sold or used by producers in the United States in 1928 was 2239 short tons, valued at $351,178, according to figures compiled by the United States Bureau of Mines, Department of Commerce, from individual reports furnished by producers. These figures represent chrysotile asbestos mined in Arizona and amphibole asbestos mined in Alabama, Georgia, Maryland and Montana. The sales of chrysotile asbestos were much greater than those of 1927, while the sales of amphibole asbestos were less than those of 1927.

The figures on asbestos sold or used by producers in Alabama, Georgia and Maryland were collected in cooperation with the state geological surveys.

Imports of unmanufactured asbestos for consumption amounted in 1928 to 230,595 short tons, valued at $9,017,891, and the exports were 850 short tons, valued at $346,632. Corresponding figures for 1927 were: imports, 223,693 short tons, valued at $8,150,340; exports, 309 short tons, valued at $48,774.

Investigation of Tests for Soundness

An Abstract

By Edmund Shaw
Contributing Editor, Rock Products

SOUNDNESS TESTS for aggregates, including the sodium sulphate test and the freezing and thawing test, have been recently investigated by the National Crushed Stone Association laboratory and a report is given in the *Crushed Stone Journal* for July. The report by A. T. Goldbeck, engineering director of the association, shows why such varying results have been secured with the sodium sulphate test and suggests a standard method of making this test which minimizes the effect of possible variables.

Comparison with freezing and thawing, however, shows that one test is not the equivalent of the other, no matter how carefully they are conducted. The report describes a simple freezing and thawing device which is about as fast as the sodium sulphate test and which gives results in a direct way. Both aggregates and mortars were tested by this device and it was found that some mortars were even less resistant to freezing and thawing than a stone which had been suspected as the cause of disintegration in concrete highways.

Sodium Sulphate Test

The report quotes the standard method of making the sodium sulphate test, used by the Bureau of Public Roads, and notes that different interpretations may introduce variables. Sodium sulphate crystallizes in at least three forms, one without water, one with seven parts of water and one with 10 parts of water, and probably still other forms, depending on conditions of temperature and humidity. The severity of the test would depend largely on the form of crystallization. Five variables were found possible within the limits of the method and tests of some of these, singly and in combination, were made. The rock used was a marble which had previously been reported to be unsound, according to the sodium sulphate test. Pictures of the crystallization and also of the rock after testing given with the report show that the variations in the method profoundly affected the results. Some of the tests would have rejected the sample and others would have accepted it at the end of five cycles, which is the number ordinarily used in highway tests. The results are shown in Table I taken from the report.

The suggested procedure for the sodium sulphate test gives every move in detail. Since it is shown that this test bears no direct relationship to the freezing and thawing test, and since the freezing and thawing test described will probably replace it altogether, it will not be abstracted.

Freezing and Thawing

Because the unsatisfactory nature of the sodium sulphate test was recognized, the National Crushed Stone Association laboratory developed a rapid from of freezing test. This uses a six compartment freezing cabinet connected with a half-horsepower, motor-compressor. Each compartment is 20 in. deep and 10 in. in diameter. Temperatures as low as 14 deg. below zero may be obtained. The pieces of stone to be tested, about 1½-in. in diameter, are immersed for half their depth in a pan of water. Each cycle consists of 16 hours of freezing and eight hours of thawing. The test is very severe, for the rock is frozen on the surface quickly, and the rapidity of the freezing has some effect on the severity of the test.

Samples of stone, gravel and portland cement mortars were tested by both the sodium sulphate test and in this freezing cabinet. The results are given in the following table, which is taken from the report (Table II).

Discussing these results, the report says:

TABLE II. RELATION OF FREEZING AND THAWING TEST AND SODIUM SULPHATE TEST

Sample No.	Per cent Loss: Freezing 50 cycles	Per cent Loss: Sodium sulphate 20 cycles
2	6	38
5	0	0
7	30	25
9	0	85
13	7	18
23	0	0
27	0	0
32	0	0
35	31	5
17	0	0
24	13	4
31	0	0
I	0	0
II	34	0
III	100	44
IV	71	40
V	6	0
VI	100	19
VII	27	2
51	0	2

Note:: Samples I to VII are portland cement mortars and the remaining samples are stone and gravel.

TABLE III. CHARACTERISTICS OF MORTAR SAMPLES, NOS. I TO VII

No.	Mix by weight	Cement, lb.	Sand, lb.	Water, lb.	Flow (½-in. drop)	W/C	Combined water, lb. (estimated)	Free water, lb. (estimated)
I	1:1	55.0	55.0	19.4	163	0.53	6.9	12.5
II	1:2	36.6	73.2	21.6	165	0.89	5.1	16.5
III	1:3	27.5	82.5	22.2	176	1.22	4.8	17.4
IV	1:4	22.0	88.0	22.9	164	1.57	4.2	17.7
V	1:2	36.6	73.2	19.2	169	0.79	5.1	14.1
VI	1:2	36.6	73.2	29.0	300	1.19	5.1	23.9
VII	1:2	36.6	73.2	23.3	205	0.96	5.1	17.2

TABLE I. SODIUM SULPHATE TESTS ON SAMPLE OF MARBLE

No. of Alterations	Test Numbers 1. OK	1. F	2. OK	2. F	3. OK	3. F	4. OK	4. F	5. OK	5. F	6. OK	6. F	7. OK	7. F	8. OK	8. F
1	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0
2	10	0	10	0	10	0	8	0	10	0	10	0	10	0	10	0
3	10	0	8	0	7	0	8	0	9	0	9	0	9	0	10	0
4	10	0	7	0	6	0	8	0	9	0	5	0	9	0	10	0
6	8	0	3	0	3	0	4	0	4	0	2	0	7	0	5	0
5	8	0	0	6	0	0	2	0	0	0	0	0	1	0	1	0
7	8	0	0	0	0	0	2	0	0	0	0	0	1	0	1	0
8	6	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0
9	4	0	0	0	9	5	1	0	0	0	0	0	0	0	0	0
10	4	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0
11	3	0	0	1	0	5	1	0	0	0	0	0	0	0	0	0
12	3	0	0	1	0	5	1	1	0	0	0	1	0	0	0	0
13	3	1	0	3	0	6	1	2	0	3	0	4	0	0	0	0
14	3	2	0	4	0	8	1	4	0	4	0	4	0	0	0	0
15	3	2	0	4	0	8	0	4	0	5	0	5	0	0	0	0
16	3	3	0	5	0	8	0	4	0	5	0	5	0	0	0	0
17	2	3	0	5	0	8	0	4	0	6	0	5	0	0	0	2
18	1	3	0	5	0	8	0	4	0	6	0	5	0	0	0	2
19	1	7	0	10	0	8	0	7	0	7	0	7	0	5	0	7
20	1	7	0	10	0	8	0	8	0	8	0	7	0	6	0	8

OK: Unaffected by test.
F: Failure.
Note: 10 pieces used in each test. Pieces showing incipient failure not noted in this table.

"On samples Nos. 9 and 51 the freezing test had no appreciable effect, whereas the sodium sulphate test had considerable effect on Sample No. 9 and little effect on No. 51. Sample No. 9, which showed very bad disintegration in the sodium sulphate test and no disintegration whatever in the freezing and thawing test, is a marble and is a typical illustration of the fact that the sodium sulphate test may give entirely erroneous results in indicating a rock to be unsound, when actually it is entirely sound and quite able to resist severe freezing.

"A similar case has been noted in which a rather coarse grained granite failed badly in less than 10 alternations of the sodium sulphate test and yet has withstood 65 alterna-

tions of the freezing and thawing test with no signs of failure whatever."

Freezing Tests of Mortars

The mortar samples, Nos. I to VII, in the above table of results, had the following characteristics, given in this table copied from the report (Table III):

In the discussion of these tests the report says:

"In Table IV are shown the quantities of cement, sand and water in the mixture and also the quantity of so-called free water is indicated. This was estimated by assuming that the same percentages of free water existed as determined by F. H. MacMillan and indicated by him in a recent report. (See Report of the Director of Research, November, 1928, Portland Cement Association.) It seems to be indicated at least that the extent of the disintegration has some relation to the amount of free water present and bears a better relation to this quantity than to the water-cement ratio.

"A coarse aggregate would have to be of very poor quality to be as little resistant as these particular mortars and stone. No. 51 hitherto under suspicion is very much more resistant than mortar—far richer than it is customary to use in concrete highways construction."

The report does not draw any definite conclusions, but it says that several things are indicated. In a condensed form these are:

That the sodium sulphate test cannot be relied upon to give identical results unless identical methods are used; the present description is not definite enough and should be written in greater detail.

The test may reject material that is entirely sound according to practice, and to the severe freezing and thawing test. The action on mortars does not seem to be so severe as the freezing and thawing test.

It is possible that disintegration of mortars by freezing is the cause of certain forms of disintegration of concrete. In these tests some mortars disintegrated to a greater extent than the worst of the coarse aggregates. Further investigations should be made to determine the effect of impurities in the sand.

It is indicated that the disintegration due to freezing and thawing of portland cement mortars is dependent not on the richness of the mortar, but rather on the amount of free water present, or the pore space left after the evaporation of free water.

Recent Research in Cements and Concretes

VOLUME change, fatigue and the extensibility of cements and concretes made from different aggregates have been the subjects of research for some years past at Purdue University. Some of the results are incorporated in Bulletin No. 34, of the university's engineering experiment station, by Prof. Hatt and Prof. Mills. The title is, "Physical and Mechanical Properties of Portland Cements and Concretes."

Beams of neat cement of different brands were tested for changes of length over a considerable time, the temperature being nearly constant so as to show only the effect of moisture. The eight brands tested were found to contract at different rates during the first drying out period of 160 days, but the changes thereafter were practically the same for all brands. These changes reflected the seasonal changes closely, expanding when the weather was moist and contracting when it was dry. The range was about 0.11% and the average total change was about 0.05%. A small but permanent expansion, or growth, took place.

Later the same beams were cured in water for 50 days and then dried at room temperature for 220 days, and the different brands contracted from 0.06% to 0.15%. They were then immersed in water for 889 days and they showed an increasing expansion. The average at the end of that time was about 0.20% and the range for the different brands was about 0.11%.

Concrete beams with coarse aggregates of limestone, gravel and slag were also tested. The mixes 1:2:3, 1:2½:4 and 1:3:6 were used, and a beam of neat cement and one of a 1:2 mortar were tested with them. Cycles of drying and wetting caused expansion followed by contraction, but with all aggregates the expansion was always less than the first contraction so that there was a slight permanent shrinkage. The gravel showed more contraction than the slag or the stone concrete, but the slag concrete showed the greatest increase in weight. The leaner mixes showed that the least change in length, and the curves for the neat cement and the rich mortar beams show much greater expansions and contractions than any of the concrete curves.

In another series gravel and limestone concretes were tested for changes in length, all of a 1:2:3 mix. Beams made with coarse, medium and fine aggregates were tested separately.

The concrete which showed the least change in length and weight in the previous series was made from a hard, non-porous limestone. In this series a softer and more porous limestone was used and it showed a greater change in both length and weight than the gravel concrete. Gradation was found to have its effect, the beams of fine aggregate showing the greatest change in length and weight. The beams of the richer mixes showed the greater changes in length, but the leaner mixes showed the greater change in weight.

The effect of fatigue on cement, mortar and concrete has been studied at Purdue for the past five years, a specially designed machine applying reversed stress to beams until failure, where failure was wanted. Age, curing, intensity of load, the mix and the aggregate used were all found to have an influence on the results as determined.

A typical mortar beam was found to undergo a fairly uniform increase in deformity up to 110,000 reversals of stress. Then cracks appeared, although it took 35,000 more reversals to break the beam. One of the curves illustrating the behavior of a plain concrete beam shows that there was no deformation up to 11,000 reversals; then there was an increasing deformation to 38,500 reversals when a microscopic crack appeared. After this the deformation increased rapidly until the beam failed at 56,000 reversals.

For 28-day concrete the fatigue limit was found to be between 40% and 60%; for four-month concrete it was 50% to 55% and for six-month concrete, 54% to 55%, these being percentages of the ultimate strength under progressive loading. The higher the load above the fatigue limit, the sooner the beam failed.

The ability of the beam to recuperate in in a rest period was very marked. With 96-hour cycles of stressing and resting well hardened beams were found to recover from the deformation given in the stressing periods during the rest periods.

Fatigue action below the fatigue limit was found to actually strengthen the beam. Gravel concrete showed the greatest increase in strength, 9% more than diabase showed, and limestone concrete showed the least, 3% less than diabase showed. The gradation of the aggregates was thought to enter into the result.

Extension and Rupture of Concrete Beams With Different Aggregates

Beams of gravel, limestone and diabase concrete were also tested for extensibility, the beams being placed in the testing machine (with third point loading) so that the upper side was in tension. The extension of this side was measured at the appearance of microscopic cracks. It was found that usually a greater extensibility accompanied a higher modulus of rupture.

The gravel aggregate showed the highest modulus of rupture, 602 lb., the diabase next, 583 lb., and the limestone lowest, 510 lb. These are the average moduli for all ages up to 180 days, although the standing was relatively the same for each age. The mix was 1:1½:3. A 1:2:4 mix with gravel aggregate had a higher average modulus of rupture, 621 lb., with a lesser unit extension.

The effect of age was very marked, the modulus of rupture (average of all aggregates) rising from 528 lb. in 14 days to 717 lb. in 180 days. The unit extension in inches, however, fell from 0.000169 to 0.000150 in 50 days, when the modulus of rupture was 528 lb. as at 14 days, and then rose to 0.000170 at 180 days. Curing was found to be very important. Gravel concrete cured for 14 days under wet burlap had a modulus of rupture of 601 lb. as against 580 lb. for three-day curing.

American Source of Grinding Pebbles

By George B. Bowers
San Diego, Calif.

PEBBLES have an important place in manufactures and building throughout the United States, hence a community with an inexhaustible supply alongside a railroad and a pavement is a valuable asset. Inexhaustible is used advisedly, meaning a dependable renewal. Such a supply exists on a beach near Encinitas, Calif. The Spanish settlers gathered pebbles there for their buildings and roads; today, gangs of men may be seen any day sorting and sacking the smooth, rounded pebbles, yet the annual supply seems never to diminish.

The source of the renewal mystifies many persons who pass along the road skirting the beach. Naturally, everyone knows that the pebbles are cast up on the beach by the waves, but from where the renewed supply?

Sacked pebbles ready for the market

Then comes along the geologist with the statement that the pebbles are not Californian; that they come from Mexico, but are not Mexican. The explanation is simple. The waters of the Colorado river once entered the Pacific over southern California instead of into the Gulf of California, as now. At that time the river brought millions of tons of pebbles from what is now Arizona and other states to cover the bottom of the Pacific ocean for miles off lower California and San Diego. That is the explanation of the source of the pebble supply.

Along the coast of southern California and miles south along lower California grow immense areas of kelp, a well-known seaweed, anchored to the shallow ocean floor by root masses. The botanist has named the root of the kelp a holdfast.

The holdfast is indeed a botanical curiosity; many are 3 ft. in diameter and equally as thick, with a concave base to fit snugly over the rocks to which it clings.

The floating portion of the plant is attached to the holdfast by what appears to be a single stem, but upon examination proves to be composed of many tubes. A tube is about ⅛ in. in diameter. The longer the kelp plant the greater the number of tubes forming the stem. Attached to the stems are numerous inch-long floaters, shaped like the floaters commonly used on seines for fishing. Each leaf is equipped with a float. When the floats and the part of the plant above water grow too large for the holdfast and its sustaining rocks and pebbles, the holdfast breaks its anchorage and is lifted. The plant and holdfast drift northward with the current. This process is accelerated during the period of the northward monsoon, when storms and waves play havoc with kelp holdfasts along the Mexican coast. When the floating plants, with their submerged holdfasts weighted with pebbles, reach the shallow water of the beach extending seaward near Encinitas, the holdfasts dragging on the bottom lose the pebbles they entwine. The released pebbles are washed ashore to replenish the banks, while the lightened kelp plant is gathered and burned for fertilizer.

A beach scene near Encinitas, Calif. The hat indicates the size of the pebbles

Hundreds of carloads of pebbles are gathered annually from a mile of Encinitas beach. The smooth pebbles lie a few feet above the water and extend along the beach in narrow ridges, some 3 ft. high. The average pebble is 5 in. long, 3 in. wide and 2 in. thick. The pebbles delivered at a nearby railway station sell for from $8 to $10 per ton, the price depending upon the size of the pebbles, their composition and usefulness.

The kelp plant, held by the man, is the carrier for the pebbles

General view of the Arizona Sand and Rock Co. plant at Phoenix, Ariz. The stiffleg derrick and clamshell bucket (left) lifts material from the scraper bucket to the hopper. The pile of boulders is a year's discard of stones too large for the crusher

Arizona's Largest Washed Gravel Plant

Pacific Coast Design and Methods Adopted by the Arizona Sand and Rock Co., Phoenix—Unusual Type of Bucket Works Successfully in 35 Ft. of Water

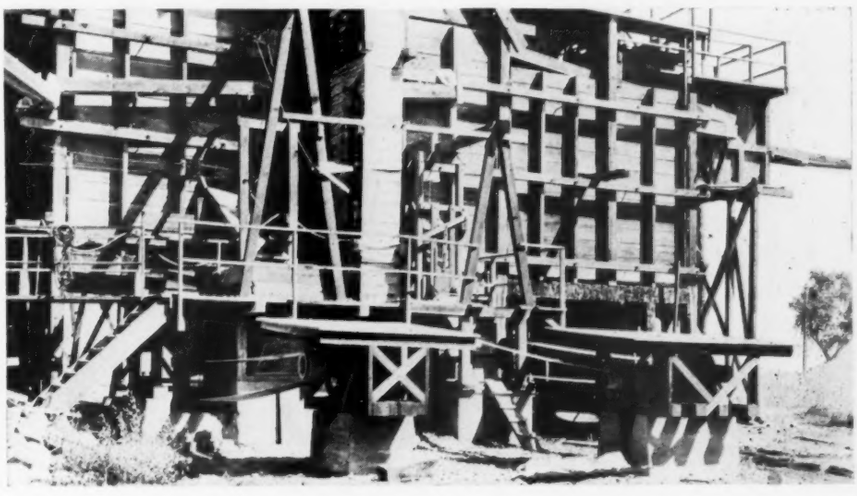
THE Arizona Sand and Rock Co. of Phoenix, Ariz., operates the largest washed and gravel plant between east Texas and the Pacific coast. It is a thoroughly modern plant a little over a year old and it was designed and built by the company. Being where the influence of California is felt, it follows the Pacific coast style somewhat in design and methods, and the name, which indicates that sand and crushed rock, rather than sand and gravel are the products, is in the same style.

The deposits around Phoenix appear to have been formed in much the same way as the washes along the Pacific coast, which are so much worked for sand and gravel, being made up of the debris resulting from the erosion of comparatively nearby mountains. But the cobbles and boulders in the Phoenix deposits are of much harder material, many of those examined when the plant was visited being of a very hard quartzite. Others were of dense and close grained igneous rocks. The deposits run between 70% and 80% gravel and a considerable proportion of this is above the 2-in. size, so a plant to handle it must include an unusually large crushing equipment in proportion to the daily output. Sand is short around Phoenix and sells at a higher price than gravel and special crushing equipment has been added to crush gravel to sand size.

The deposits are fairly deep and a good sized proportion of the material lies below water. Practice in the eastern or middle-western states would probably call for a cableway dragline to meet these conditions of much oversize and digging below water for a plant of small or moderate tonnage. But at the Arizona plant a modification of the scraper bucket is in use. The form shows quite plainly in the accompanying picture. It has two straight sides and a semi-cylindrical end and no bottom or top except for a small piece across the bottom at the back. It is pulled in by a single bridle chain and it discharges itself in the same way that a scraper bucket does, by leaving the material behind it on the reverse motion.

This bucket was designed and built at the plant and it works successfully in 35 ft. of water, much deeper than scraper buckets of the ordinary type are asked to work in. There are two in use, one of a 1-cu. yd. and one of 3-cu. yd. capacity. The larger, working in the main deposit, which consists largely of gravel, is handled by a 125 hp. Western hoist. The other, which works in a deposit consisting largely of sand, is handled by a 75 hp. Lidgerwood hoist.

The bucket working in the gravel pit, from which most of the feed to the plant is obtained, draws the material to where it can be picked up by a clamshell bucket on a stiffleg derrick. This shows at the left of the large picture. The clamshell discharges into a hopper which is over the primary, an 11x20-in. Telsmith, jaw crusher driven by a 35 hp. General Electric motor. Pieces



One of the secondary crushers (left) and the crushing rolls (right). Note the double motor drive of the rolls

which are too large for this crusher are thrown out by hand. The amount so rejected is not of much consequence, as the pile which represents a year's discard shows.

The crusher discharge goes to an 18-in. bucket and belt elevator which lifts it to a Gilbert screen of Stephens-Adamson make. Water is added here from the discharge of a 4-in. centrifugal pump. The oversize goes to two secondary crushers, a 6-in. Traylor finisher and a 4½-in. Traylor finisher. The first has a 60 hp. motor and the second a 40 hp. motor. The discharge of both these crushers goes to the same elevator that receives the discharge of the primary crusher. Undersize goes to a second Gilbert screen which takes out an intermediate product. The sand is recovered in a hopper bottomed tank with a belt drag. All products go to bins which have a combined capacity of 300 tons.

The material from the second pit, which is sand with a little gravel, is brought in to the plant by a truck which dumps it where the clamshell can get it. It joins the material from the main pit in the hopper above the primary crusher.

The deficiency in sand is also made up by crushing gravel, the gravel being taken from the bins and fed to a set of 12x24-in. Traylor rolls. This installation is unusual in that each roll is driven through an independent belt by a 15 hp. motor. The advantages of giving each roll its own motor, principally a lessened liability of choking, are well enough known and sets of large rolls have been driven that way. It has generally been considered too expensive an installation for small rolls, but Mr. Perkins, the engineer of this plant, says that this idea is wrong and that the advantages of individual drives can be had at no greater cost than driving from a single motor through the required belts and shafting.

The discharge of the rolls goes to a bucket and belt elevator and from this to a revolving screen 8 ft. long and 60 in. in diameter, with ⅜-in. holes, which was built at the plant. The undersize goes to the sand bin and the oversize returns to the rolls.

On account of the hardness of the bank material, manganese steel has to be used for crusher jaws and other wearing parts and the bill for this is an important item of cost. The manganese steel is bought from the American Manganese Steel Co. and the Alloy Steel Co. of Los Angeles. Different makes of motors are used in the plant, but all those driving crushers are of General Electric Co. make.

Storage system with shuttle belt on frame and inclined belts. Recovery is by locomotive crane

Unusual Storage System

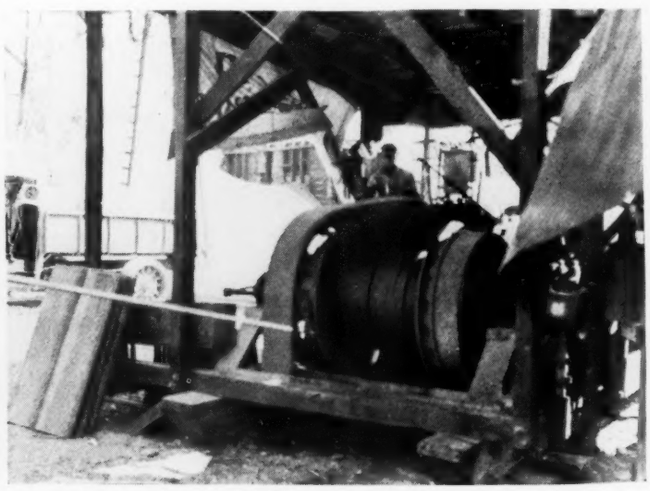
A notable feature of this plant is the storage system. The products are stored under a trestle 250 ft. long on which is a track for a shuttle belt in a frame. The belt is only 60 ft. long, but it can be placed anywhere along the track and run in either direction and this enables it to discharge at any point required. The feed for the shuttle belt comes from two inclined belts, one for sand and one for gravel, fed from the regular plant bins. One of these is 187 ft. long, the other 196 ft. and both, and the shuttle belt also, are 20 in. wide. Recovery from the storage is by Northwest locomotive crane.

The storage system was designed at the plant and the Brown-Bevis Co. of Los Angeles furnished the conveying machinery and the belts.

Much of the product is sold batched. The batcher is in the bottom of a bin used for truck deliveries underneath the shuttle belt track and filled by the shuttle belt. It was made by the Madison Iron Works of Los Angeles.

This is the only plant in Phoenix making railway shipments for general commercial uses, but the amount so shipped is not large. The market in Phoenix and the towns immediately around it absorbs the most of the production and the greater part of this is in the radius of truck delivery. Twenty trucks were being constantly employed at the time the plant was visited. So far as possible, the trucking is done by contract, but the company has its own fleet of 8-yd.

The unique bucket which is dragged in like a scraper but which works in 35 ft. of water



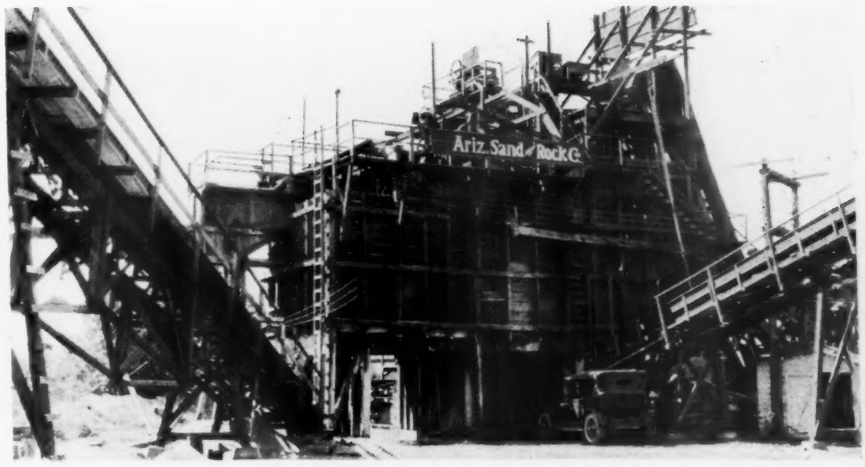
The 125-hp. hoist which handles the 3-cu. yd. bucket working in the main gravel deposit

trucks of Mack and General Motors make.

The products of this plant have a great reputation as concrete aggregates and this reputation is shown to be justified by the tests which state, municipal and other testing agencies have reported. A recent test gave the following for 1:2:4 concrete made with these aggregates: 48 hr., 1689 lb./in.^{2}; 7 days, 2880 lb./in.^{2}, and 28 days, 4824 lb./in.^{2}.

Each of the above is the average of three tests.

D. W. Kelley is president of the company and manager and John Perkins is engineer and operating superintendent. Mr. Perkins has built and operated several plants on the Pacific coast. The office of the company is at the plant.



Bins and washing screens. The belts feed the shuttle belt over the storage piles

Distinction Between Research and Development

"RESEARCH AND DEVELOPMENT are closely associated in practice but differ fundamentally in their nature," writes L. A. Trofimov, development engineer, Electric Controller and Manufacturing Co., Cleveland, Ohio, in a recent issue of *Iron Age*. Since this fundamental distinction is not clearly understood in some of the rock products industries, that are now engaged in cooperative research, it seems desirable to abstract the following from Mr. Trofimov's discussion:

Because of the misconception of the separate fields of research and development many assume that industry needs more research men, while actually it needs development engineers. As will be seen later, there are no difficulties in supplying the former if industry wants more, while there are as yet no sources for the supply of the latter.

The word research was introduced into industry from the realm of science and simply means search again. Research, obviously, has been supplying working material for science. When the manufacturer found it profitable to undertake some research in his factories, he distinguished it from the work that had previously been conducted in colleges and governmental institutions by the term "industrial research." There is no marked difference between industrial and scientific research except in restriction and purpose. Thus, scientific research is the process of collecting facts on phenomena of nature and on relations between them, with no immediate practical application in view; on the other hand, industrial research is a similar search in a specified field with definite practical application in view.

The *nature* of research is best characterized by the word discovery; that is, to find something that always existed but was not known. The *function* of research is to search nature for something new. It may be a new element or combination of elements, a new substance, or an unknown law, or better information on laws of nature and relations between them. Therefore the functions of the research man are similar to those of an explorer, investigator or true scientist.

The best research mind is of the single-track type, capable of persistent and deep efforts for exploring the unknown. A detailed and profound knowledge of the field under investigation is necessary. The training of research men must be the same as that of the physicist who specializes in one of the branches of his science and has a general knowledge of research technique. The present system of college education is capable of producing as many research men as industry needs.

There is a greater need of capable men for applying research to industry. This does not mean that the research man is incapable of applying his findings—of course he does so if he happens to possess such an ability. But in doing so he performs an act which in itself is fundamentally different from research, and may be correctly described by the word invention. The distinction between discovery and invention lies in the fact that the first always existed, while the second comes into existence by the creative faculty of the mind. Therefore we may define the development engineer as an "industrial inventor."

Now and then one person may possess both investigating and inventing ability and perform the functions of both the research man and the development engineer. But with the growth of industry the scope of each activity broadens to such an extent that it becomes difficult and inefficient to assign both functions to one person. Both research and development departments may therefore be found in some industries.

But in producing development engineers, we deal chiefly with inventive ability, which, it is assumed, is beyond our control. Experience seems to show that a man with good knowledge of general physics makes a better development man than a physicist specialized in one branch. Furthermore, a man who knows the fundamentals of several engineering branches is better than an expert. If we add to this a knowledge of development technique, we have the outline of the kind of education he must have. The present educational systems do not produce engineers of this kind and there is no source of obtaining them except by accidental selection.

To show the proper place of development departments, take two examples, one of large industry with a considerable variety of products, and the other of small industry with only one or two products.

The former can afford to maintain research departments where both scientific and industrial research are done, because such industry, covering a wide field and a variety of products, can usually get direct financial return on the research budget. There must also be a development department whose chief function is to find the best applications of the findings of research. This includes conceiving ideas of solutions or applications, experimenting, designing, constructing, testing and advising production.

The small industry cannot afford to maintain research departments and has to be content with published data. This cannot be properly considered as a great handicap, because, as we know, all new findings of research become known after their first practical application, which is never the best. Proper development departments of any small industry may and usually do find better use of another's discoveries. If this were not true, small industries with no research departments would pass out of existence; as a matter of fact, they do not.

Therefore, small industries with a limited variety of products should have development departments for the purpose of enlarging their sales, through the best application of published research data. The functions of these departments should be the same as those in the large industry. There will even be a little research carried on in a small plant because existing and available information is not always sufficient.

Further Comparative Tests on Crushed Stone and Gravel Concrete

Abstract and Comments

By Edmund Shaw
Contributing Editor, Rock Products

THE *Crushed Stone Journal* for June gives the results of tests on gravel and crushed stone concrete made with equal quantities of cement per cubic yard. This series of tests was carried out as the next step in test procedure mentioned in the report of the original test, comparing the flexural strength of crushed stone and gravel aggregates, which was published in the March *Crushed Stone Journal* and in ROCK PRODUCTS, April 2.

In this new series A. T. Goldbeck, director of the bureau of engineering of the National Crushed Stone Association, who conducted the tests, chose 6.3 sacks of cement per yard as the cement content for all tests and assumed 0.75 as the water-cement ratio that would give the required consistency As the table shows, the cement factor was held within 0.04 sack per yard. The water-cement ratio had to be increased or decreased according to variations in the characteristics of the aggregates, the variations being from 0.68 to 0.83.

The method of designing the mix is important in tests of this nature, and it is given at great length in the original paper. Stated briefly, it follows in part the procedure described by Profs. Talbot and Richart in their bulletin, "The Strength of Concrete, Its Relation to the Cement, Aggregates and Water." According to this the solid volume of the coarse aggregate in a cubic foot of concrete divided by the absolute volume in a cubic foot of coarse aggregate should equal 0.775. The absolute volume of the coarse aggregates required was in every case 0.775 times the absolute volume in a cubic foot of aggregate.

Having detremined the absolute volumes of the cement, coarse aggregate and water, with an allowance of 0.27 cu. ft. for air, these were added together and subtracted from 27. The difference would be the absolute or solid volume of sand required for a cubic yard of concrete. If the first batch made by calculation did not have the required consistency more water was added, and a new calculation for the amount of sand required was made on the new water-cement ratio.

The same coarse aggregates and the same fine aggregates that were used in the original test were used in this series of tests. The results of the new tests with the properties of the concrete are given in Table II of the original paper which is reproduced here.

In discussing these tests Mr. Goldbeck notes first that the water-cement ratio is lower with the gravel concrete than the stone concrete, and that the difference amounts to about 0.07 in the water-cement ratio, which is about ½ gal. per sack of cement. He points out that the coarse aggregates used represent a considerable range in characteristics and says:

"If these results are typical, then it might be said that in a broad, general way the water-cement ratio which may be used with crushed-stone concrete is higher than that necessary with gravel concrete of like consistency."

But the water-cement ratio is shown to have no more relationship to the modulus of rupture in these tests than it had in the original tests. This is shown in Fig. 2 of the paper which is reproduced here. In discussing this Mr. Goldbeck says:

In Fig. 2 is shown the relation between modulus of rupture of concrete and the water-cement ratio. For the same water-cement ratio there is seen to be a rather wide range in strength results. For instance, for a water-ratio of approximately 0.70 the range in modulus of rupture varies from a maximum of 786 to a minimum of 531. The maximum value is approximately 150% of the minimum. The minimum value is obtained with a coarse aggregate which is decidedly weak in structure and the maximum value with a good grade of limestone gravel containing crushed fragments. It is to be noted on this diagram that the crushed-stone concretes average considerably higher in modulus of rupture than the gravel concretes, notwithstanding the fact more water was necessary in the crushed-stone mixes than in the gravel mixes. In all cases the cement content was 6.3 bags per cublic yard. The extra water was necessary because of the additional sand used in the crushed-stone mixes.

In designing concrete mixes for cross-breaking resistance, it is indicated by the test results that a higher water ratio may be used with crushed-stone concrete than with the gravel concrete when both concretes have equal cement content per cubic yard and if these results are typical, a higher cross-breaking strength may still be expected with the stone concrete than with the gravel concrete. There are exceptions to this, as will be noted by the fact that some of the gravels, particularly those having crushed pieces, run higher in cross-breaking strengths than some of the stones. Reference to Table II will show several cases where, although the gravel concrete slightly exceeds the stone in compression, their strength values are reversed in cross-breaking. This serves to emphasize the fact that it is not safe to assume that because the concrete has high compressive resistance it will likewise have high resistance in cross-bending.

As in the previous tests, the modulus of rupture and the percentage of wear are com-

Table II.—Showing Properties of Concrete with Different Coarse Aggregate Graded as Received. Approximately Same Cement Content and Same Consistency. Age 28 Days. Cured in Moist Room.

No.	Coarse Aggregate	Proportions Dry Cement	Proportions Dry Sand	Proportions Volume Coarse Aggregate	Cement Bags per cu. yd.	Corrected W/C	Slump	Flow	Compressive Strength lbs. per sq. in.	Modulus of Rupture lbs. per sq. in.
35	Stone....	1	1.99	3.33	6.27	0 77	1.5	172	4490	768
2	Stone....	1	1.99	3.33	6.30	0.78	1.75	176	4300	745
3	Gravel...	1	1.67	3.43	6.33	0.69	1.5	159	4750	633
5	Stone....	1	2.19	3.29	6.28	0.83	1.25	169	4030	715
6	Gravel...	1	1.66	3.32	6.30	0.71	2.25	170	4310	607
7	Stone....	1	1.92	3.32	6.32	0.77	1.5	164	4890	755
8	Gravel...	1	1.69	3.31	6.30	0.70	2.0	168	5020	786
9	Stone....	1	1.83	3.30	6.28	0.79	1.25	159	4170	647
12	Gravel...	1	1.79	3.31	6.30	0.77	1.5	163	4360	650
13	Stone....	1	1.92	3.36	6.34	0.78	2.0	164	4890	760
17	Gravel...	1	1.73	3.32	6.30	0.68	2.0	164	4610	642
23	Stone....	1	1.87	3.32	6.31	0.78	1.75	162	4790	759
24	Gravel...	1	1.79	3.34	6.28	0.69	2.0	165	4850	707
27	Stone....	1	1.92	3.28	6.30	0.80	1.5	166	4480	769
28	Gravel...	1	1.51	3.36	6.32	0.71	1.5	160	4720	626
29	Gravel...	1	1.71	3.33	6.31	0.70	2.0	166	4730	704
32	Stone....	1	1.79	3.41	6.27	0.77	1.75	163	4660	690
31	Gravel...	1	1.57	3.41	6.27	0.70	1.5	163	4240	531
28–1	Gravel...	1	1.60	3.24	6.32	0.73	1.75	164	4480	613
31–1	Gravel...	1	1.64	3.29	6.29	0.72	1.75	160	4060	587
35	Stone....	1	1.98	3.29	6.30	0.76	1.75	164	4580	770

pared and their relationship is shown in Fig. 3. Mr. Goldbeck says of these results:

In Fig. 3 results are shown for the modulus of rupture of concrete and percentage of wear of both the stone and the gravel as determined by the Deval abrasion test and by the gravel abrasion test in the case of the stone and gravel samples respectively. It is quite evident that there is a rather decided trend in the results shown. Those materials which have a particularly high abrasion loss also have a low modulus of rupture and those having a low abrasion loss have a high modulus of rupture. There is an exception to this in the single instance of sample No. 8, a limestone gravel containing crushed fragments. This curve does not seem unreasonable, for those aggregates having a high abrasion loss are composed of fragments which fracture rather easily and when subjected to tension they readily pull apart. Some doubt has existed in the minds of testing engineers as to the value of the abrasion test, whether it be the old Deval abrasion test or the newer gravel abrasion test as used for gravel samples. Certainly, the present test results show very strongly that the abrasion test may be of considerable value in indicating the effect which the coarse aggregate will have on the modulus of rupture of concrete. It seems to be the case that weak fragments will produce low cross-bending resistance. There does not seem to be any particular effect on cross-bending resistance, however, when the percentage of wear is under approximately 10%, for both high and low results are obtained in modulus of rupture with materials varying from approximately 3% to approximately 10%.

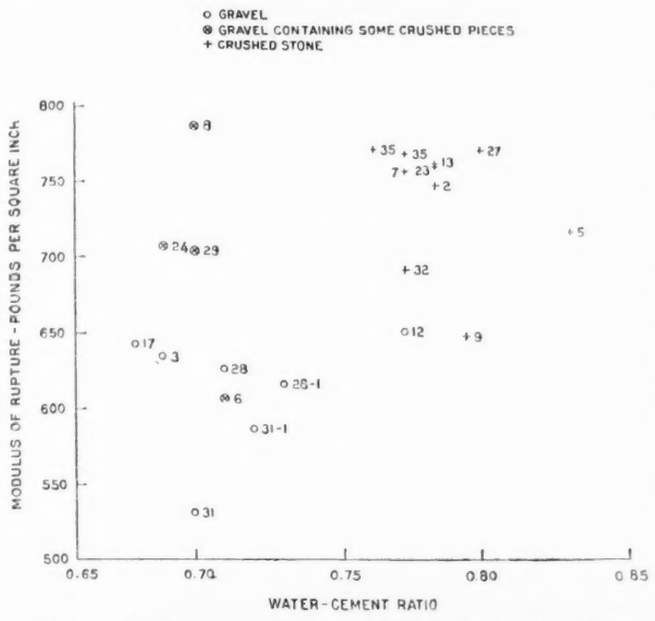


Fig. 2. Modulus of rupture vs. water-cement ratio when various aggregates are used. Data based on 6.3 bags cement per cu. yd. and age of 28 days

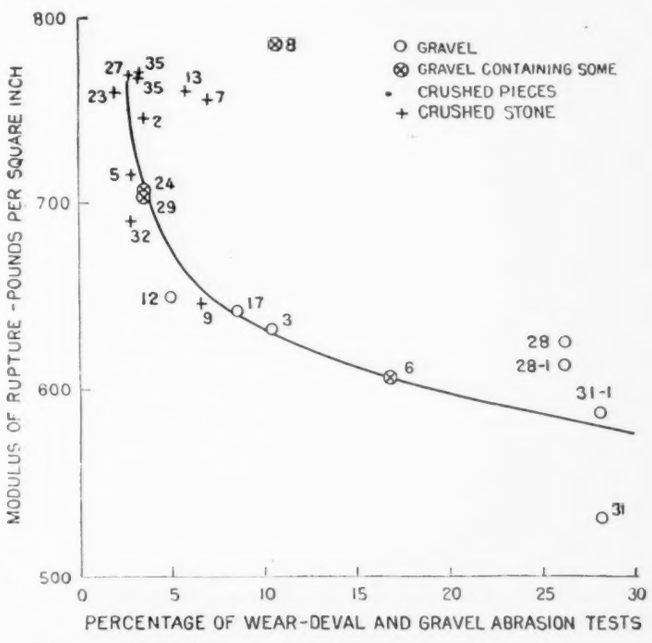


Fig. 3. Effect of percentage of wear on modulus of rupture. Age, 28 days; cement, 6.3 bags per cu. yd.

Conclusions

The following conclusions seem to be warranted on the basis of the particular materials used in these tests:

1. When crushed stone and gravel concretes have like cement contents per cubic yard, a somewhat higher water-ratio, equaling 0.07 (½ gal. per bag of cement) may be used with crushed-stone concrete than with gravel concrete. This is merely an average value from which there may be considerable variation, depending upon individual aggregate characteristics.

2. Notwithstanding the higher water-ratios necessary in the crushed-stone concretes than in the gravel concretes, the crushed-stone concretes in these tests average considerably higher in modulus of rupture than the gravel concretes. There are individual exceptions and reversals of this rule, particularly when the gravel contains crushed fragments.

3. The relative cross-breaking resistance of concretes cannot be judged by their relative compressive strengths. Aggregates of extremely poor quality may give comparatively high compressive resistance but have low resistance to bending. The quality of the aggregates affects both compressive and bending resistance of concrete but is more important in influencing the cross-bending than the compressive resistance.

4. The gravel abrasion test seems to be a good measure of the characteristics of gravels which may produce concrete of low cross-bending resistance. A very high percentage of wear is indicative of weak material, which will weaken the beam strength of concrete.

5. The rounded smooth surfaces of certain gravels seems to adversely affect the beam strength of concrete (Samples 3, 12 and 17).

It may seem that the difference in modulus of rupture obtained with these various coarse aggregates is comparatively small and unimportant. Actually small differences in modulus of rupture may be highly important. It must be remembered that the modulus of rupture is a measure of the resistance of concrete to cracking. The modulus of rupture test is of the greatest importance for designing concrete for concrete highways, because it is almost invariably the case that the tensile stresses produced by bending in concrete highways under the action of traffic are high, and for the sake of economy, and because no danger of loss of life is involved, a concrete road slab is designed with very little factor of safety against cracking under loads. Consequently, if the modulus of rupture is low, the strength of the slab may be exceeded frequently, whereas if the modulus of rupture is high, the safe working stress will likewise be high and may not be exceeded by the tensile stress produced by traffic. Therefore, concrete having low resistance to bending cracks frequently under the action of traffic and that having

COMPARISON OF RESULTS OF ORIGINAL SERIES AND NEW SERIES OF TESTS

	Coarse aggregate	Orig. cement factor	New cement factor	Orig. comp. str.	New comp. str.	Orig. M. of R.	New M. of R.	Per cent increase, cement	Per cent incr., comp. str.	Per cent increase, M. of R.	Orig. W/C ratio	New W/C ratio
2	Stone	6.16	6.30	3760	4300	703	745	2.3	14.5	6.0	0.81	0.78
3	Gravel	5.86	6.33	3630	4750	558	633	8.0	31.1	13.5	0.88	0.69
5	Stone	6.34	6.28	3670	4030	674	715	—1.0	11.0	6.1	0.83	0.83
6	Gravel	5.77	6.30	3450	4310	535	607	9.0	24.9	13.5	0.84	0.71
7	Stone	6.08	6.32	4300	4890	720	755	4.0	14.0	4.8	0.88	0.77
8	Gravel	5.78	6.30	3960	5020	678	786	9.0	27.2	16.0	0.85	0.70
9	Stone	5.94	6.28	3600	4170	640	647	5.7	16.0	1.2	0.86	0.79
12	Gravel	5.89	6.30	3506	4360	599	650	7.0	24.5	8.3	0.85	0.77
13	Stone	6.13	6.34	3800	4890	666	760	3.5	28.8	14.2	0.88	0.78
17	Gravel	5.82	6.30	3360	4610	555	642	8.0	37.0	15.8	0.81	0.68
23	Stone	6.01	6.31	3810	4790	717	759	5.0	26.0	6.0	0.85	0.78
24	Gravel	5.89	6.28	3960	4850	679	707	6.5	22.8	4.0	0.81	0.69
27	Stone	6.00	6.30	3680	4480	686	769	5.0	21.9	12.2	0.84	0.80
28	Gravel	5.59	6.32	3440	4720	535	626	13.2	37.0	16.8	0.88	0.71
29	Gravel	5.77	6.31	3846	4730	622	704	9.5	23.1	13.0	0.83	0.70
32	Stone	5.88	6.27	3370	4660	638	690	6.8	38.1	8.1	0.86	0.77
31	Gravel	5.63	6.27	3160	4240	517	531	11.2	34.0	2.7	0.86	0.70
35	Stone	6.13	6.27	3620	4490	701	768	2.3	24.1	9.5	0.80	0.77
35	Stone	6.09	6.30	3770	4580	712	770	3.5	21.5	8.0	0.81	0.76
28-1	Gravel	5.59	6.32	3440	4480	535	613	13.5	30.0	14.5	0.88	0.73
31-1	Gravel	5.63	6.29	3160	4060	517	587	12.0	28.5	13.5	0.86	0.72

high resistance cracks infrequently because it is not over-stressed.

The important influence of aggregates on the modulus of rupture of road concrete thus becomes apparent. High-grade aggregates giving high modulus of rupture are much to be preferred, for they provide a considerable safeguard against excessive cracking and early deterioration of concrete road slabs. Concrete for road slabs should be designed, not to have a given compressive strength, but to have a given modulus of rupture.

Comment on the Above Tests

In order to show the differences between the results of the original series and the new series of tests the principal properties of the concretes have been placed in parallel columns in the accompanying table. These are: Original and new cement factors, original and new compressive strengths, original and new modulus of rupture and the original and new water-cement ratio. From these have been calculated the percentage of increase in cement, the percentage in increase in compressive strength and the percentage in increase fo modulus of rupture.

The first fact that strikes the eye is that there is a widely variable percentage of increase in the amount of cement used, ranging from 0.1% (No. 5) to 13.2% (No. 28). At the same time there is a fairly constant increase of compressive strength ranging around 25%. The average for the stone is 21.5% and the average for the gravel is 29%. This is readily accounted for by the lower water-cement ratios as shown in the last three columns of the table. The single exception is with No. 5. This had the same water-cement ratio, 0.83, in both tests and 1% less cement in the new test, and yet there was an increase of 11.0% in compressive strength.

This seemed so inconsistent that Mr. Goldbeck was asked by letter if there was a typographical error made in this part of the table. He replied that there was not, and he called attention to the grading of this sample as given in the report of the original test. This showed 3% on 1½-in., 45% on 1-in., 91% on ½-in. and 99% on No. 4. The grading was so uniform that the sample contained 50% of voids. With the 1:2:3½ mix used in the original test the mixture was undersanded and harsh, hence the strength was not so great as would be indicated by the water-cement ratio, and this is in accordance with the water-cement ratio theory. In the second series of tests proportionately more sand was used and the voids were better filled with mortar.

A comparison of the cement factors of stone and gravel concrete shows that in every case more cement was used with a gravel than with the stone with which it is paired. In the original tests it was shown that the gravel samples contained less voids than the stone samples and hence had a lower cement factor. Therefore a greater increase in cement was needed with gravel than with stone to bring them to the same cement factor, 6.3 sacks per yard.

For the same reason, the higher voids in the stone samples, more sand had to be used with stone than with gravel. In every case the relation of stone to sand was considerably higher than that of gravel to sand. In all cases it was higher than that used in the previous series of tests. This is shown in Table II.

But it will be noted that the increase of, compressive strength is fairly constant for both stone and gravel. Hence we may say that the increase in strength in the stone concretes was due more to the increase in sand than cement, while the increased strength in gravel concretes was more due to increased cement than increased sand.

This bears out the conclusions Mr. Goldbeck has made from his earlier work. On several occasions he has called attention to the advantage of using a high sand content with a coarse aggregate that is rough and angular, such as crushed stone or crushed slag. This would seem to apply quite as well to gravel having a high proportion of crushed fragments. It is also in line with one of the recommendations of the Bureau of Public Roads, which calls for a higher sand content with rough and angular coarse aggregates.

In almost every case the gravel concretes show a higher modulus of rupture *proportionately* than the stone concretes as compared with the previous tests. A notable exception is gravel No. 31, which in one test showed only 2.7% increase in modulus of rupture, with 11.2% increase in cement. This gravel, as noted by Mr. Goldbeck, appears to be one that is not adapted for use where flexural strength is wanted, although in both cases it gives a satisfactory compressive strength. In this respect it is something like the sandstone (No. 61) tested in the recently reported tests of the Bureau of Public Roads, which gave the highest compressive strength of all samples but only an average value of modulus of rupture.

Points of Difference

There are two points in which the results of the present tests fail to agree with the recently reported tests of the Bureau of Public Roads (See Rock Products, July 6). One of these is the effect of the shape of the pieces of coarse aggregate on the water-cement ratio. The Bureau of Public Roads tests showed little difference due to this factor and the report says:

"It seems reasonable to suppose that, other things being equal, an aggregate having rounded surfaces would require less water than one having angular surfaces. However, inspection of Table 6 fails to reveal any significant differences which may be attributed to this factor."

In the present series of tests, however, the gravel concretes all show a lower water-cement ratio for the same consistency, the average difference being, as Mr. Goldbeck points out, about 0.07. As concluded by the Bureau of Public Roads' report, it appears that characteristics of the coarse aggregates may be more important than such slight differences as this in the water-cement ratio. The increase in compressive strength is fairly uniform for both stone and gravel, in spite of such differences in the water-cement ratio as are shown in the last column of the table.

The other difference in conclusions concerns the effect of the percentage of wear on the flexural strength. The Bureau of Public Roads' report concludes: "That, within the range in quality covered by this study, there is no relation between the quality of the coarse aggregate, as measured by the abrasion test, and the strength of the concrete."

Mr. Goldbeck concludes that the gravel abrasion test is a good measure of the adaptability of gravels to produce concrete of a high flexural strength. In his previous report he showed a possible relationship between wear and flexural strength, but he could not be definite because of the varying cement factor. In the present series the cement factor is equal for all tests. And the relationship of percentage of wear to flexural strength seems quite definite in the easily abraded gravels.

But it will be noted that the range in quality is much wider than that covered in the Bureau of Public Roads' tests, as it includes two or three gravels with very high percentages of wear.

It should be remembered, however, that the percentage of wear is no criterion of compressive strength. Some of the weakest gravels were quite satisfactory aggregates for compressive strength. From an economic standpoint they are to be preferred where only compressive strength is wanted, as is shown by the low cement factor obtained with them in the previous series of tests.

The value of these tests cannot be placed too high. In connection with the previous tests, and the tests of the Bureau of Public Roads, facts about aggregates are being brought out which are of the highest importance to the concrete-making industry. They are perhaps only a beginning of a real research into the characteristics and properties of aggregates, but they are an excellent foundation on which to erect a structure of further work.

Concrete Masonry in Outstanding Buildings

TYPICAL examples of a large number of buildings of all types are illustrated in the booklet "Concrete Masonry in Outstanding Buildings," published by the Portland Cement Association, Chicago. These serve to illustrate representative buildings in which concrete masonry has been used.

Production of Magnesia From Dolomite

By Dr. C. R. Platzmann

THE separation of dolomite, $MgCO_3 \cdot CaCO_3$, into MgO and CaO is a problem which has interested chemists for decades. Thus far its chemical solution on a large scale has not yet been attained, but the problem appears to be of sufficient importance to be treated again. This article is intended to furnish a brief outline of the more important literature on this subject; but it also includes a report on the writer's experiments of a few years ago, and up to now unpublished.

Action of Alkali Bicarbonates

K. Kippenberger[1] has investigated the action of bicarbonate alkalies upon $MgCO_3$. The solubility of the $MgCO_3$ is increased by this action; whereas the carbonates of the alkaline earths, which are present at the same time are eliminated as insoluble matter. When freshly precipiated $MgCO_3$ is suspended in an alkali bicarbonate solution, deposition of $MgCO_3$ crystals starts within 1 to 2 hours and ends after about 18 hours. These crystals contain no alkali, and on examination were found to consist of $4MgCO_3 \cdot 15H_2O$. Kippenberger established his process for producing magnesia from dolomite upon these experiments. Dolomite was dissolved in commercial HCl or NHO_3, a slight heating accompanying the process. An excess of soda solution was then added in order to eliminate Ca and Fe. The filtrate was treated with a bicarbonate solution, the whole shook for 20 minutes then filtered. Following this the $MgCO_3$, crystallized out of the filtrate for the solubility of the magnesium in the sodium bicarbonate solution is but 9.95 g. $MgCO_3$ per 1000 ccm. of solution containing 12.96 g. of $NaHCO_3$.

Treadwell and Reuter[2] investigated the solubilities of the bicarbonates of calcium and magnesium, their existence and their solubility in non-carbonated and in carbonated water. The summary of this work follows:

1. Calcium bicarbonate as such is stable in a hydrous solution. Its solubility is 0.385 g. per liter at 15 deg. C. and at a mean barometric level.

2. Magnesium bicarbonate exists in solution only when uncombined carbonic acid is present; at a partial pressure of zero, a mixture of the bicarbonate and carbonate results. This contains 1.954 g. of the bicarbonate and 0.7156 g. of the carbonate per liter at 15 deg. C. and at a mean barometric level.

3. The solubility of the calcium bicarbonate is not encroached upon by $N/10$ NaCl solutions.

The investigations of Knorre[3] take up first of all the origin of the $MgCo_3 \cdot 3H_2O$; the author shows three ways for this to form: (1) solutions of Mg bicarbonate are left exposed to air; (2) alkali-bicarbonate is added to the solution of a magnesium salt; the elimination occurring a few days later with a yield of 80%; (3) the amorphous precipitation from the soda and magnesium salt solution changes after a few days to $MgCO_3 \cdot 3H_2O$ with a yield of 90%. These processes are effective only at temperatures above 15 deg. C. In reference to the second process no excess must be taken when using potassium bicarbonate, for it would cause impurities of potassium-magnesium carbonate. The double salt, $MgCo_3 \cdot KHCO_3 \cdot 4H_2O$ decomposes into crystals of $MgCO_3 \cdot 3H_2O$, which fasten to the wall of the vessel, and K_2CO_3.

Investigation of the Double Salt

Auerbach[4] also has investigated the double salt of the formula $MgCO_3 \cdot KHCO_3 \cdot 4H_2O$. He determined thereby that $MgCO_3 \cdot 5H_2O$ precipitates below 15 deg. C. The solubility of $MgCO_3 \cdot 3H_2O \cdot KHCO_3$ solutions of various concentrations was investigated further at 15-, 25- and 35-deg. C., and it was found that the bottom liquid changed under these conditions into the double salt, $MgCO_3 \cdot KHCO_3 \cdot 4H_2O$. Experimental conditions were maintained to check as far as possible any tendencies for the bicarbonate to decompose into carbonate and uncombined CO_2. The results of these determinations were prepared graphically in such a manner that the entire Mg content of the solution appears as function of the entire K content. The isotherms obtained thereby rise in a straight line corresponding to the saturation with $Mg_2H_2(CO_3)_2$ until they are intersected by a descending convex curve which corresponds to the saturation by double salt. At the point of intersection both substances at the bottom of the liquid are in equilibrium with a solution of definite composition. The solubility of $MgCO_3 \cdot 3H_2O$ decreases with an increase in temperature; whereas the solubility product of the double salt increases and the complex constant of the double salt remains nearly unvaried. Therefore the decomposition of $MgCO_3 \cdot 3H_2O$ as well as the separation and then also the formation of the crystallized double salt from $MgCO_3 \cdot 3H_2O$ and $KHCO_3$ solution must take place under development of heat.

Raikow[5] determined that magnesium bicarbonate $MgH_2(CO_3)_2$ is formed by the action of CO_2 upon Mg salt solutions.

According to Abegg[6] the formation of the double salt, $MgCO_3 \cdot KCHO_3 \cdot 4H_2O$ from the suspension of magnesium carbonate trihydrate in saturated potassium chloride solution under simultaneous introduction of CO_2 is derived according to the following:

$$3MgCO_3 \cdot 3H_2O + 2KCl + CO_2 = 2MgCO_3 \cdot KHCO_3 \cdot 4H_2O\,(cryst.) + MgCl_2.$$

Upon contact with cold water the double salt enters first as such in solution; then decomposition starts in soon afterwards and Mg-carbonate trihydrate is precipitated as a reversion product, according to the equation:

$$MgCO_3 \cdot KHCO_3 \cdot 4H_2O \rightleftarrows MgCO_3 \cdot 3H_2O + KHCO_3 + H_2O.$$

B. Waeser[7] states that: If a burned dolomite which is suspended in H_2O is oversaturated with carbonic acid, the MgO enters into solution before the CaO. Furthermore if CO_2 at 5 to 6 atmospheres of pressure is passed into the hydrous suspension of calcined dolomite, the Mg dissolves first with the formation of $MgH_2(CO_3)_2$. Steam is then passed into the solution filtered from the remaining lime sludge; this causes the precipitation of a specially unstable and slightly basic carbonate.[8]

According to the D.R.P. 159,870, magnesium carbonate trihydrate is produced as an end product from $Mg(OH)_2$ by treating $Mg(OH)_2$ with 20% CO_2 bearing gases at 3 atmospheres pressure.

The D.R.P. 280,738 is based on the above data and involves a process for the production of $MgCO_3$ from lime bearing magnesium carbonates. The minerals themselves or the products obtained from them by burning are pulverized and mixed with alkali—or alkali bicarbonates. This mixture is then dissolved in water saturated with CO_2. Thus the magnesium goes into solution at 60 to 70 deg. C. as an alkali double salt, the lime precipitating as carbonate. The filtered solution changes at 100 deg. C. into insoluble magnesium carbonate, where the alkali remains dissolved as carbonate.

As a support to this process and to the available literature, the author has personally undertaken experiments, for which two kinds of dolomites of the following composition were available:

Analysis	Dolomite 1	Dolomite 2
SiO_2	1.02%	0.84%
$Al_2O_3 \cdot Fe_2O_3$	0.96%	1.88%
CaO	32.82%	31.67%
MgO	18.96%	20.51%
Loss on ignition	45.80%	45.00%
Total	99.56%	99.90%

Since the experiments were started always with burned dolomite, it appeared necessary to determine first of all the most favorable burning temperature. This was done in the following manner: Some of the material

was crushed to pea size and the other material was pulverized to about the fineness of cement. Each grade of material was then burned at various temperatures between 700 and 900 deg. C., also varying the time cycles of the calcination. No difference could be determined between the coarser and the fine grade of material between 800 and 900 deg. C. After 8 to 9 hours of burning at 800 deg. C. all carbonic acid was expelled in both cases, and at a burning temperature of 900 deg. C. more than 99% of all the carbonic acid was driven off after one hour. It was shown that at a temperature of 700 deg. C. the pea-size material gives off CO_2 more easily.

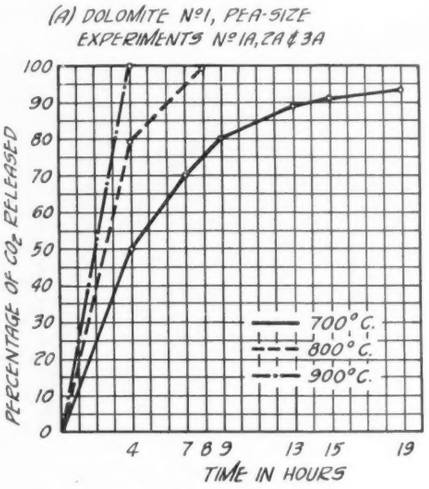


Fig. 1. Effective calcining times of dolomite ground to pea-size

(The dissociation of dolomite into CO_2 and CaO as well as MgO starts at about 650 deg. C.) In this case 95% of the CO_2 was expelled after a burning period of 18½ hours; whereas in using the pulverized dolomite only 80% of the entire carbonic acid was given off after 18 hours. The results of these experiments are shown diagrammatically in Figs. 1 to 3. Based on these results, a uniform burning temperature of 900 deg. C. over a period of 2 to 4 hours was selected for all experiments.

All experiments were started with 50 grams of dolomite; this gave, when burned, from 27 to 28 g. of non-carbonated oxide mixture which was composed of 15 to 17 g. CaO and 9 to 11 g. MgO. This mixture was slaked with 200 ccm. of boiling water, allowed to stand for 12 to 18 hours and then more water added to make 1000 ccm. After this there was added the quantity of alkali carbonate (in this case $KHCO_3$) necessary for the reaction or solution of the magnesium oxide and the precipitation of the lime. Assuming that 50 g. of dolomite contains about 10 g. MgO, the amount of $KHCO_3$ to be used is calculated as follows:

$$MgO : KHCO_3 = MgCO_3 : KMCO_3 \cdot xH_2O$$
$$40.9 : 91.1 = 10 : x$$
$$x = 22.61 \text{ g. } KHCO_3$$

The suspension of 1000 cc. contained therefore 27 to 28 g. of burned dolomite, and also 22 to 25 g. of $KHCO_3$ in solution. The correct adjustment to the solubility conditions in bicarbonate solutions is signified by 10 g. magnesia per liter.[9] The reaction was now effected through a rapid mechanical agi-

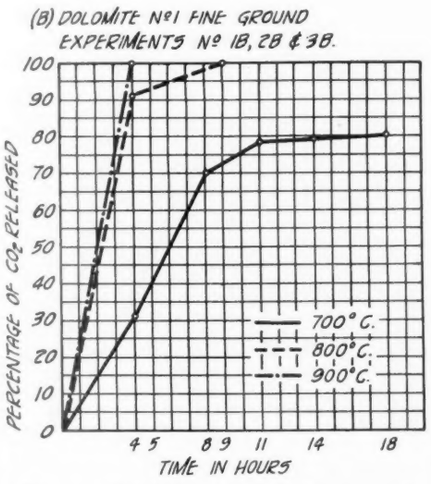


Fig. 2. Calcining time of fine-ground dolomite at different temperatures

tation, the agitator operating at 400 to 500 r.p.m.; during the agitation, CO_2 gas was forced into the solution. Chemical reaction was considered complete after about 6 hours, the greater portion of the lime having been precipitated as carbonate. Impurities in the stone such as SiO_2, Al_2O_3 and Fe_2O_3 were also precipitated.

The insoluble precipitates, calcium carbonate, etc., were separated by means of a suction filter from the soluble Mg-K-double salt, washed free of solubles, dried and weighed. A residue of about 30 to 32 g. was obtained; this included CaO, SiO_2, Al_2O_3 and Fe_2O_3. Analysis of these lime residues showed a great regularity in the composition. These compositions were as follows:

	CaO	MgO	CO_2
Experiment No. 7.....	47.88%	4.38%	44.54%
Experiment No. 8.....	44.33	7.57	44.98
Experiment No. 9.....	50.34	2.39	44.40
Experiment No. 10.....	50.79	2.54	43.40
Experiment No. 11.....	49.50	4.38	43.16
Experiment No. 16.....	49.59	4.40	42.38
Experiment No. 17.....	49.49	4.01	42.20
Experiment No. 19.....	50.22	3.77	42.44

It is possible to put all the magnesia in solution if the introduction of the carbonic acid is continued sufficiently long. But in practice such a method would likely be uneconomical throughout, since naturally the last particles of magnesia are resistant to reaction for the longest possible time. Another assumption would be an exceptionally extended reduction in size of the material, in order to forestall an adsorption of magnesia by the lime, and in order to prevent that individual particles of magnesia, enclosed by lime, are not kept away from the action of CO_2 and $KHCO_3$. Furthermore, quantitative washing would have to be resorted to and this would call for large volumes of water. Considering that, according to the above analysis, a yield of 87 to 90% in magnesia is obtained, the process can be deemed to give excellent results.

The reaction can be followed volumetrically by determining the alkalinity of the $KHCO_3$ solution and then observing its increase due to solution of MgO. In addition, the process can be followed up chemically with exceptional simplicity, for with the beginning of the reaction an increase in temperature is noted, which in time adjusts itself again to the normal temperature; the length of time used for this depends on the progress of the reaction. A survey of a number

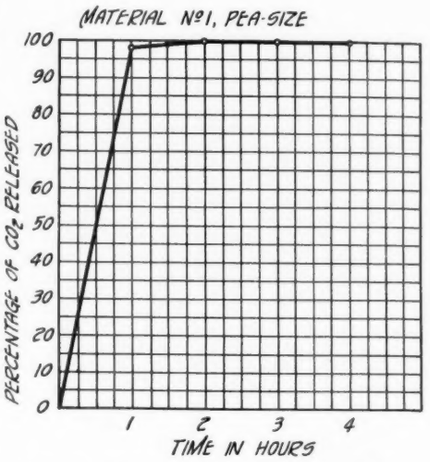


Fig. 3. Escape of CO_2 gas at calcination temperature of 900 deg. C.

of these experiments is given in the following table:

	—Temperature Rise, Deg. C.— Experiment No.					
After:	11	12	13	14	15	Av. Rise
15 min.	3.00	4.5	5.37	4.88	4.90	4.53
30 min.	.....	6.5	8.25	8.25	7.34	7.59
45 min.	.....	.....	9.17	9.67	8.75	9.20
1 hr.	8.00	5.5	8.83	9.00	7.75	7.82
2 hr.	5.33	4.0	4.75	4.88	4.37	4.67
3 hr.	4.00	5.5	2.75	3.34	2.50	3.62
4 hr.	.....	4.5	1.88	1.75	0.75	2.22
5 hr.	1.63	1.0	1.00	0.67	0.38	0.94
6 hr.	0.50	0.0	0.00	0.00	0.00	0.10

The average values of the above temperature measurements have been plotted in the diagram (Fig. 4). They indicate that the reaction takes place most vigorously during the first hour and that after that time there sets in the slow adjustment to the outside temperature. The intensity of the increase in temperature and, therefore, the course of the reaction, is dependent upon the following factors: (1) r.p.m. of the agitator; (2) quantity of CO_2 introduced, and (3) the speed of the CO_2 distributing itself in the solution.

The quantity of lime contained according to the figures of analysis in the lime residues was calculated to that quantity which is contained in the initial material in the dolomite. The magnesia yield was calculated on two bases: first, on the actual quantity of magnesia contained in the dolomite and, second, on the amount of magnesia which entered in solution after deduction of the

small amounts precipitated with the lime residue. The elimination of the magensium salt from the double salt solution, which can be done also in vacuum, occurred at 100 deg. C. The solution was heated about 15 minutes to boiling and then filtered; the magnesium carbonate trihydrate eliminated by this process was washed until the wash waters gave no test for potassium. The air dried magnesium carbonate trihydrate was then calcined to the constant weight and weighed as MgO. The following table gives details concerning the yields:

Test No.	Dolomite No.	Yield in Lime g. weight	%	Yield in Magnesia g. weight	%*	%†
10	1	15.98	97.36	.....	.....	.....
11	1	15.67	95.41	.....	.....	.....
16	2	15.33	96.79	7.68	85.95	74.86
17	2	15.80	99.79	8.72	96.64	85.01
19	2	16.47	100.00	8.92	98.29	86.98

*Per cent figured with regard of the impurities of the lime residues.
†Per cent based upon the initial material.

The weight figures given in the above table refer to CaO and MgO.

The magnesia obtained in the experiments on analysis proved to be quite pure; no SiO_2, Al_2O_3 and Fe_2O_3 were found and in the testing for lime only an opalescent turbidity, indicating traces, developed. The MgO content was always more than 99%, as the following determinations show:

Experiment No.	MgO content (per cent)
14/15	99.62
17	100.00
19	99.93
20	99.91
22	96.50 (agitated only 4 hours)

Summary

1. By treatment with CO_2 and $KHCO_3$ burned dolomite is split up into its constituent parts in such a manner that carbonate of lime is precipitated and $MgCO_3 \cdot KHCO_3 \cdot xH_2O$ enters in solution.

2. Upon heating the resulting solution to 100 deg. C. elimination of $MgCO_3 \cdot 3H_2O$ sets in, from which MgO can be obtained by calcining.

3. The final product obtained is a nearly chemically pure magnesia.

4. The lime residue can be utilized as fertilizer lime.

5. The $KHCO_3$ solution goes back in the process.

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(8) Inrisch: *Die chemische Industrie.* 1893, p. 369.

() K. Kippenberger: Loc. cit.

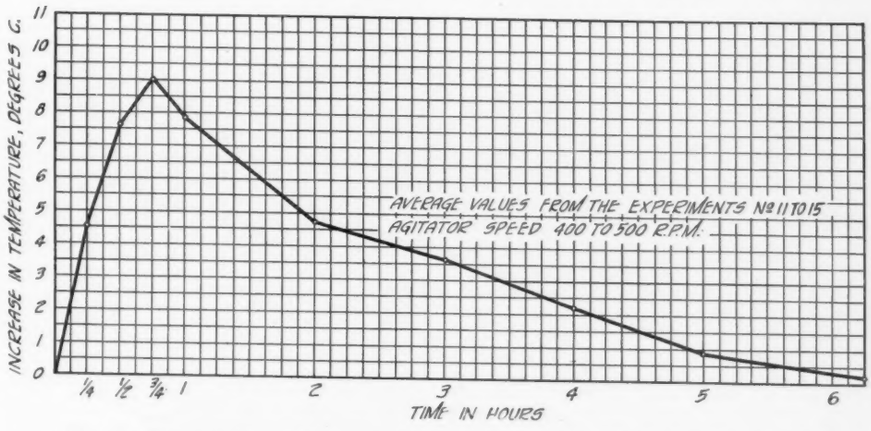


Fig. 4. Temperature changes occurring during the CO_2 saturation of the bicarbonate solution of burned dolomite

Potassium and Calcium Chloride from Lime, Sodium Chloride and a Mine Tailing

IN the state of Utah are many deposits of low-grade lead-silver ores whose metal content could be recovered by applying the chloridizing roasting and brine leaching process. However, when this process is applied to the treatment of such ores, soluble sulphates are formed during the chloridizing roasting, and these soluble sulphates greatly lower the solubility of the lead when the roasted ore is leached with a brine solution. Therefore, the problem which presents itself, in connection with the application of this process to such ores, is to remove the sulphate radical from the solution during brine leaching of the roasted ore. As a result of experimentation by the Intermountain Experiment Station of the United States Bureau of Mines, Salt Lake City, Utah, it was found that this radical could be successfully removed by the addition of calcium chloride to the brine leaching solution, as it causes the calcium sulphate to be precipitated out from the solution. However, as the market price of calcium chloride is about $40 a ton, it is not commercially feasible to use this reagent at that price for removing the sulphate radical from the brine solution.

It is estimated that calcium chloride could be produced from salt, sulphuric acid, and limestone for approximately $35 a ton, but this cost is also prohibitive so far as the use of calcium chloride as a reagent is concerned for the purpose above indicated. Hence experimentation was undertaken by the Bureau of Mines to determine whether it might not be possible to devise a method for producing this reagent cheaply. As a result of this experimentation a method has been worked out whereby the calcium chloride can be produced by heating salt, silica and ferric oxide to 850 deg. C. in the presence of steam. The hydrochloric acid vapors evolved can be fixed as calcium chloride without taking any precautions during the condensation to diminish the amount of moisture. The success of this process depends largely on the mechanical behavior of such a mixture of siliceous material and salt, and on the concentration of the calcium chloride obtained.

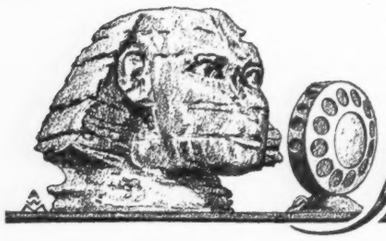
The commercial production of cheap calcium chloride would admit of the chloridizing roasting and brine leaching process being applied not only to the treatment of low grade lead-silver ores but also to blast furnace flue dust. At present this flue dust is returned to the furnaces, which not only diminishes the useful capacity of the furnace by giving it a high circulating load, but also reintroduces the volatilized impurities. The production of cheap calcium chloride would permit a leaching process for the treatment of this flue dust.

In connection with the application of the chloridizing process to the treatment of ores, it is possible to form valuable chlorides other than those of the metals, as, for example, potassium chloride.

Use of Lime in the Ammonia Industry

CIRCULAR NO. 373 of the Department of Commerce, Bureau of Standards, contains recommended specifications for quicklime for use in the distillation of ammonia liquors obtained in the coke and gas manufacture. The specifications are one of a series covering the use of lime in the various chemical processes.

For this work the Bureau of Standards recommends that the quicklime should slake to form a product of which not less than 95% will pass a No. 50 sieve and not more than 10% will be retained on a No. 200 sieve. The available lime (CaO) should be 90% or more, based on the nonvolatile portion of the material.



Hints and Helps for Superintendents

Ingenious Repair of a No. 8 Gyratory Crusher

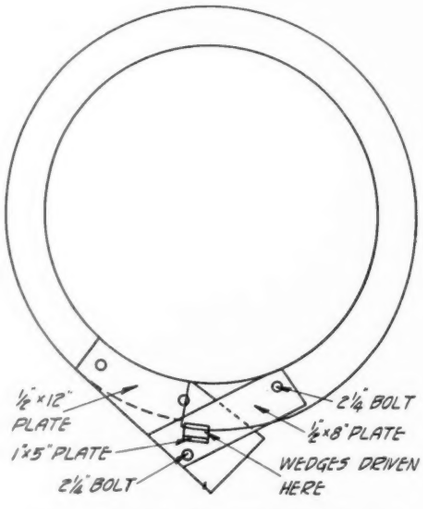
THE ILLUSTRATIONS show how employes of the Connecticut Quarries Co. patched up a No. 8 gyratory crusher—one of the secondary crushers at its Plainville, Conn., plant—in the midst of a busy production season. The crusher broke on a Wednesday morning—at 8 a.m.—when the pin from the padlock of a Marion 37 shovel-bucket sheave got into it. The pin went through the primary Buchanan jaw crusher without injury to that crusher.

The crusher was split from top to bottom through both shell castings, and one piece in the upper half of the shell was broken out entirely. The crusher is a No. 8 McCully that has been in service since the plant was built. At 8 p.m. Saturday, the crusher was ready to operate again, and when the plant was visited a week later was entirely serviceable, after 10 to 12 hours a day continuous operation and at last accounts—October 1—was still good.

Two crews were kept continuously on the job from Wednesday morning to Saturday night, under F. H. Edwards, general superintendent, who staid on the job himself from start to finish. Mr. Edwards was formerly master mechanic of the company, so he knew from the start what he was doing.

One sketch—these were made especially for ROCK PRODUCTS by Mr. Edwards—shows the ingenious method used to close the cracks in the middle rings of the crusher, after the attempt to do this with jacks failed. Band plates were bolted to the top and bottom rings, as shown, and wedges driven, until the edges of the broken shell were brought together.

The crusher shells were patched all around with plates formed to the contour of the shell. Every other plate had the holes in the plate threaded, as well as the holes in the shell castings. These plates acted as wedges, or key-plates, to provide rigidity, when the intervening plates were in place. All the plates were attached to the shell with cap screws. Some special forgings were required for the vertical tie bolts, or rods, and for reinforcing the crusher opening.



Top view of the repaired gyratory

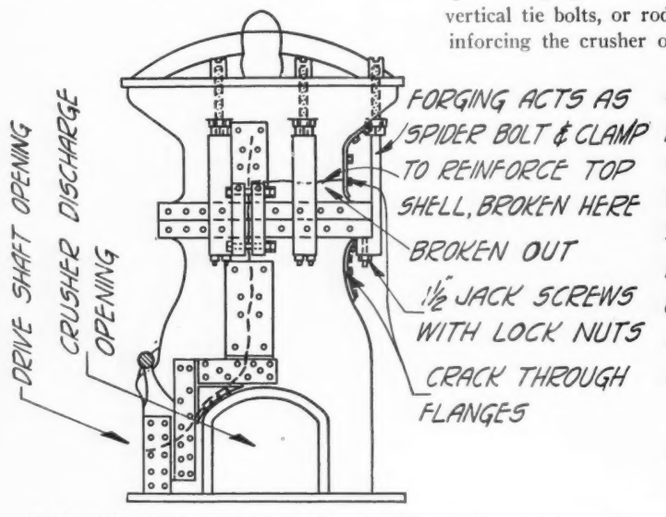
When the shell plates were in place the edges of contact with each other were electrically welded, and babbitt metal was poured in back of them to insure a full bearing against the shell castings.

The job is said to have cost in the neighborhood of $1200, but it saved a very costly delay at the height of the production season.

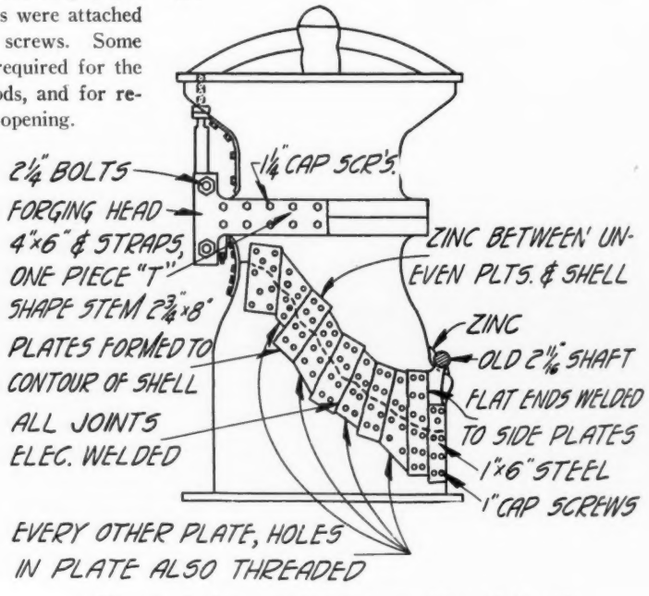
Grease Mixer and Gun Cuts Car Lubrication Costs

FOR low-speed bearings, such as those of mine-car axles, it is possible to use a cheap grade of lubricant. Although heavy crude oil is ordinarily used, it is not suitable, on account of its tendency to harden or gum. On the other hand, a liquid grease is too expensive to use in view of the great waste entailed in lubricating cars. Heavy crude oil and ordinary No. 3 cup grease, mixed in the proportion of three parts to two, made a good substitute for the expensive grease, thus reducing the cost of car lubrication.

At the Pilares mine of the Moctezuma Copper Co. a combination grease mixer and grease gun, shown in the accompanying drawing, has been devised by A. W. Sansburn, foreman of the mine blacksmith shop. The apparatus consists of a tank, *B*, of approximately 30-gal. capacity, fitted with a detachable lid, *A*, through which is intro-


DRIVE SHAFT OPENING
CRUSHER DISCHARGE OPENING
FORGING ACTS AS SPIDER BOLT & CLAMP TO REINFORCE TOP SHELL, BROKEN HERE
BROKEN OUT
1½" JACK SCREWS WITH LOCK NUTS
CRACK THROUGH FLANGES

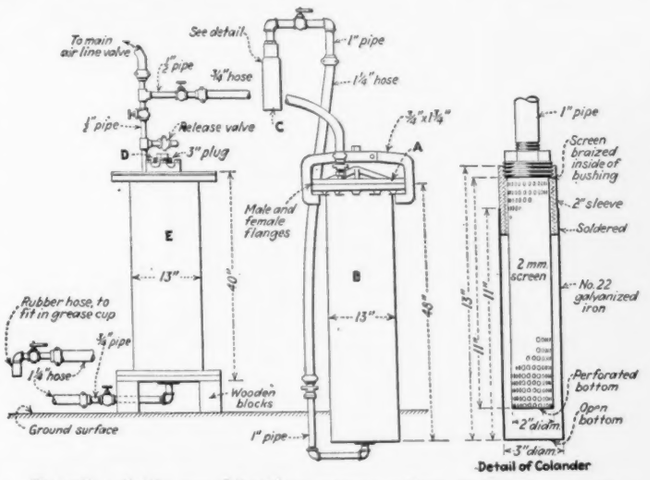
Right side of the crusher giving details of the repair to the crusher shell


2¼" BOLTS
FORGING HEAD 4"×6" & STRAPS, ONE PIECE "T" SHAPE STEM 2¾"×8"
PLATES FORMED TO CONTOUR OF SHELL
ALL JOINTS ELEC. WELDED
EVERY OTHER PLATE, HOLES IN PLATE ALSO THREADED
1¼" CAP SCR'S.
ZINC BETWEEN UNEVEN PLTS. & SHELL
ZINC
OLD 2¼" SHAFT
FLAT ENDS WELDED TO SIDE PLATES
1"×6" STEEL
1" CAP SCREWS

The steel plates fastened in position (left side of crusher)

duced a mixture of oil and grease, which has previously been churned together by hand in the oil barrel until the grease has been broken up to ½-in. size. This is forced by means of air under pressure into a 1-in. pipe at the bottom of the tank, through a 2-mm. screen or colander, *C*. The colander insures a uniform mixture of the lubricants of the consistency of a liquid grease.

From the colander the mixture is forced through *D* into the grease gun, *E*. The latter consists of a tank 13 in. in diameter by 40 in. in length, the top of which is fitted with a pipe for the introduction of air. The grease from the container *E* is forced through a ¾-in. pipe from the bottom of the tank through a rubber hose, *F*, to the lubricating cups of the mine cars, and the flow is continued until grease appears at the ends of the axle housings, assuring complete lubrication. Portable grease guns for the mine are also charged from tank *"E."—Engineering Mining Journal.*

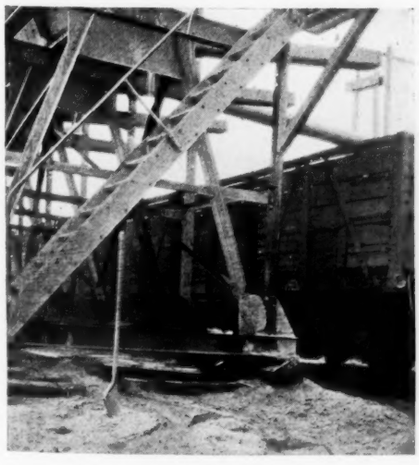


Details of the combination grease mixer and grease gun

Movable Washing Plant

THE LYMAN Richie Sand and Gravel Co. is the largest sand and gravel operator in Nebraska, securing its material from 23 different plants. Recently it adopted a new practice which it will continue in the future; this is, the building of all-steel, movable washing and screening plants.

These units consist of a 10-in. dredge mounted on suitable pontoons, the pump delivering to a stationary scalping screen set at a steep angle. From the scalper the sands flow over a steel apron that functions to spread the material over a large area. The sand after being spread out passes over a second, steeply inclined screen that makes the two materials that the plants produce, namely, sand-gravel for the oversize and sand passing through the screen. The amount of sand retained with the gravel is regulated by a rubber mat that can be raised or lowered over the screen in such a manner that the greater the area of screen surface exposed the greater amount of sand that will pass along with the gravels.



The "shoe" mounting of a movable washing unit

The plants are relatively small, but have a large capacity and can be moved from place to place by simply attaching a wire rope or chain to the lower structure and then a locomotive, tractor, etc., shifts the whole plant.

A Car Loading Hint

IT IS the custom at many lime, cement and gypsum plants to sprinkle the floors of cars to be loaded with waste materials. Gypsum calcining plant foremen are especially inclined to sprinkle a thick bed of discarded stucco or fibered hardwall over the car floor, the idea being to protect the car content from moisture and from dirty or oily floors.

The practice should be discouraged, as in many cases the warehouseman unloading the cars gets the idea that the material came from broken or leaking sacks, and is apt to sweep it up, sack and sell it. Naturally, when material of this kind gets to the user there is an immediate howl that is reflected back to the mill superintendent.

By far the better method is to demand from the railroad company clean cars and cars that will not leak, keeping the floor clean of unnecessary plaster, for by this method the sackers on the trucks can load easier and faster. Likewise the unloading crew will not have to drag their trucks through several inches of material, a task not easy when a truck loaded with 600 to 800 lb. of plaster is to be handled.

Change Room for Employes

SOME rock products companies provide their workmen with individual steel lockers all arranged in a suitable building along with shower baths, etc. When the lockers are new and the working conditions at the quarry or mine dry, such arrangements are good. But, when the clothes, wet or damp, are hung in such lockers, an attendant unpleasant odor of musty clothes results.

A "dry" change room at a cement mill where the clothes are hoisted to the top of the room

Now that the Riverside Cement Co., Riverside, Calif., is about to change from open quarry to underground mining of limestone, it has provided a "dry" or change room similar to that found in many western mining camps. Each workman is supplied with a hanger on which to hang his clothes after which they are hoisted to the top of the room by a suitable rope and pulley. The ropes can be locked in position if desired.

Stemming for Upper or Lifter Holes

AT THE rip-rap quarry of the Hauser Construction Co., near Riverside, Calif., the stone is shot down by a combination of lifter, breast and down holes. Stemming for the down holes is a simple matter, but for the breast and lifter holes it is the company's practice to use dirt or rock dust enclosed in paper containers made in the shape of ordinary dynamite cartridges. This permits effectiveness and rapidity during that operation.

Arthur P. Burke

IN THE sudden death, on September 26, of Arthur P. Burke, president of the Atlanta Sand and Supply Co., Atlanta, Ga., the sand and gravel industry lost an outstanding and well-beloved member. He died in Charlotte, N. C., while returning to Atlanta from a trip to Washington, D. C. He was 52 years old.

As a sand and gravel producer he was noted for his enterprise and his originality. He was ever a leader in his field. He had long been a director of the National Sand and Gravel Association. But he was different from the average busy business man. He found time for many of the finer things in life. He was a leading musician of Atlanta, for example, among other things. Indeed, his character and accomplishments were such that all who knew him could not but revere him as *the perfect type* of southern gentleman, more common in literature apparently than in real life.

A. P. Burke

The impression of A. P. Burke that will live longest with his friends was that of kindliness. His tact, courtesy and gentle manner of speech never left him, even in the times when he was tried. If he disagreed with an opinion he would say so readily enough, but the manner of saying so was never such that it would give offense. On this account, the friendships that he made were of the deep and abiding sort, and those who saw him once a year, as at the annual convention of the National Sand and Gravel Association, felt closer to him, perhaps, than they did to men whom they liked and respected and met much oftener.

And coupled with this kindliness was sincerity, and a belief in whatever he undertook. Whatever engaged his attention, his business, association affairs, or such a minor matter as entertaining a friend who was passing through Atlanta, he gave himself to it whole-heartedly. Men believed in him because he believed in himself.

It was a privilege to know him; one may say without exaggeration that one was the better for having known him; for his standards were high and he held many of the ideals that are held by those who look on life as something more than a struggle for financial success or a reputation.

North Shore Material Co. Buys Libertyville Tract

THE Lawrence and Houlihan farms, located north of Libertyville, Ill., and consisting of 90 acres, have been purchased by the North Shore Material Co. from a syndicate of Evanston business men. The consideration is understood to be $70,000, says the Libertyville *Independent*.

The properties are bordered by Milwaukee avenue on the west and the Des Plaines river on the east.

The property is underlaid with rich deposits of gravel which will be taken out. Eventually the one or more lakes that will be formed will be graded and improved with homes in keeping the program now being carried out at the old gravel pit in the Park avenue district.

Slump in Building Affects Lime Production

SLUMP of building operation in New York and Boston, due chiefly to scarcity of mortgage money, has caused the Rockland and Rockport Lime Corp. to cut down its production during the present season.

The company is operating at the present time six of its seven gas kilns, and three of the kilns in the Gregory shed—a showing considerable at variance with that which is usually made with summer just past. Curtailment is also seen in the quarry region, where operations are now concentrated in the so-called soft rock quarries.

Continuance of operations is assured by the fact that the corporation has a steady demand for its lime which is used for general purposes—notably the paper mills, which demand lime in generous quantities. The agricultural department has continued to show increased sales, this having been its best year, in fact. The outlook for 1930 is even better, based on the price for potatoes and general betterment in farm conditions.

A decided improvement in building conditions by next spring is the very reasonable expectation and the Rockland and Rockport Lime Corp. is directing all of its plans to that end.

The company will move soon into its spacious quarters in the second story of the W. H. Glover Co.'s new block.—*Rockland* (Me.) *Courier-Gazette*.

Inverness, Fla., Phosphate Mines to Reopen Soon

ALTHOUGH unconfirmed, several reports state that rock phosphate operations in the vicinity of Inverness, Fla., will be resumed within a short time. One large mine, north of Hernando, will open shortly and start shipping, it is said. The Mutual Mining Co.'s operation, south of Inverness, is also said to be planning to reopen.

The mines were shut down because the phosphate market has been off for some time, but information now available is to the effect that the market is getting better, and that due to the high phosphate content of the hard rock variety, a new demand is being rapidly created for this product.—*Inverness* (Fla.) *Chronicle*.

California Lime Products Concern Expands

THE Universal Silicate Stucco and Lime Products Co., Los Angeles, Calif., which was recently organized to take over the affairs of the Abramson Bode Corp., operating a lime plant at Lindsay, Calif., and the Universal Silicate Stucco Co., operating a stucco plant in Los Angeles, has purchased the hydrate plant of the Union Lime Co., Tehachipa, Calif. This operation has been abandoned and the hydrate plant, with a Schulthess hydrator, has been dismantled and is being re-erected at the lime plant at Lindsay.

R. L. Vance New Vice-President of Monolith Midwest Co.

AT a directors' meeting held recently, R. L. Vance of the Denver office was elected vice-president of the Monolith Portland Midwest Co., and will have general charge of the company's operations in this section. Mr. Vance has been engaged in the cement industry for 19 years and before coming to Denver in April of this year was an executive in the Monolith Portland Cement Co. He has become a permanent resident of the city. This move is for the purpose of establishing the closest possible contact with conditions in the territory served by the Midwest company, as Denver is the headquarters from which the company's operations in the middle west and intermountain states are directed.

A New Shiely Gravel Plant

CONSTRUCTION of a $135,000 sand and gravel washing plant, to furnish material for ballasting work on the Great Northern railroad, and also to supply commercial demands, is under way by the J. L. Shiely company of St. Paul, at Verendrye, in McHenry county, east of Minot, Minn. A crew of 60 men has started to work constructing the plant.—*Duluth* (Minn.) *Herald*.

Editorial Comment

Another Argument Against Price Cutting

Chalk up another convincing argument against price-cutting and the demoralization of an industry that results from price-cutting and unbridled competition. For price-cutting and demoralizing competitive conditions in an industry are directly associated with accident rates. Witness the lime industry. In 1928 every branch of the quarry industry materially improved its accident rate per 1000 men employed with the *single exception of the lime industry*. The lime industry's accident rate increased from 166.08 to 182.04.

After years of steady progress in cutting down accidents —each year better than the previous one—the portland cement industry's record in accident prevention has in the last several weeks got some severe "bumps" in the form of nine fatal accidents in the month of August alone!

Why? Because successful accident prevention work *must* have inspiration, continuous inspiration, sympathy and cooperation from the top—from the highest executives. In the lime industry last year and the cement industry the last few weeks the higher executives have had too many troubles to give the same attention to safety work they should, they must give.

Thus there is a direct relation between safety in industry and normal, healthful conditions in that industry. The public does not, and never will, really profit from cut-throat competition. For in such periods not only is quality of the product likely to suffer, but the energies and brain power that should be devoted to constructive measures are diverted to destructive ones. Just as the heads of the two greatest nations of the world are now emphasizing the waste of public resources in competitive building of armaments, so in business destructive competition can lead only to waste of money and resources, that in the last analysis are the public's.

A Rank Injustice

The newspaper campaign recently waged in Los Angeles against the portland cement industry is an insult to the intelligence of the people of Los Angeles. For any reader with any comprehension of industry and business—and who in this day has not?—must be able to see the rank injustice of it. The cause of this hulabaloo is beyond us; probably in times past the cement industry there has incurred a public distrust and certain newspaper publishers, for purposes of their own, desire to capitalize this beyond all reason, right or justice.

The whole thing grew out of an offer by one of the cement companies to supply cement for the proposed San Gabriel dam for $1.40 per bbl., in bulk, at the mill. The offer was for nearly 3,500,000 bbl., and under conditions which probably justified the producer in making such a price, because every producer, and every other business man with a knowledge of the fundamentals of production, knows that such a very large order under favorable conditions of delivery (that is mainly regularity of delivery) justifies a lower price than ordinary business. For example, there are no sales costs, no advertising costs, no dealer costs, no warehousing costs, no credit risk, etc.—and, of course, many economies in operating costs are possible in addition.

The Los Angeles newspapers, or some of them at least, immediately jumped to the conclusion that if this producer could sell cement for the San Gabriel dam at $1.40 per bbl. he is robbing Los Angeles county because he now sells it cement at $1.74 per bbl (mill base). Of course nothing could be more absurd and unjust, because any one at all familiar with the cement industry knows that the 34c differential can easily be accounted for by the anticipated savings referred to above.

Newspapers are supposed to be run in the public interest. Publishers continually boast that they are public service organizations. Are they in this case? The exact opposite is the truth. We feel certain that the cement company in offering to give the public the advantage of his cost-saving instead of sticking to the established price, which he might have done, was acting far more in the public interest than the newspapers are in hounding him because of his offer. The newspaper tactics are mighty well calculated to prevent that producer or any other from ever taking the same step again—in other words, to discourage them from acting in good faith to share their savings with the public.

Newspaper publishers and editors are human, and act from human motives. Either they are purposely or ignorantly unjust. In either case they can be made to see the light by means at the disposal of all business men. It should be the aim, not alone of the cement industry, but of every industry and business man in Los Angeles to see that the true facts are given the light of day and that the publishers and editors of these newspapers are properly disciplined for attempting to destroy the fair name and reputation of a great industry. It happens to be the cement industry today, but what business man knows that his business or his industry may not be the next for a similar unjust and poisonous attack.

The Los Angeles Chamber of Commerce, if it has sufficient vision, enterprise and "intestinal stamina," ought to come to the defense of business as business in a case like this, for the public's education and welfare if for no other reason—in our humble opinion!

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[29]	10- 9-29	91	93	
Alpha P. C. new com.	10- 7-29	29½	30	75c qu. Oct. 15
Alpha P. C. pfd.	10- 7-29	116	.....	1.75 Sept. 14
American Aggregates com.[29]	10- 9-29	44	49	75c qu. Mar. 1
Amer. Aggregate 6's, bonds	10- 4-29	94	.....	
American Brick Co., sand-lime brick	10- 8-29	.....	14	25c qu. Feb. 1
American Brick Co. pfd., sand-lime brick	10- 8-29	.....	78	50c qu. Aug. 1
Am. L. & S. 1st 7's[28]	10- 9-29	94	97	
American Silica Corp. 6½'s[49]	10- 9-29	90	100	
Arundel Corp. new com.	10- 8-29	42½	43	50c qu. Oct. 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	10- 9-29	80	90	
Atlas P. C. com.	10- 7-29	40	45	50c qu. Sept. 3
Beaver P. C. 1st 7's[20]	8-23-29	98	101	
Bessemer L. & C. Class A[4]	10- 4-29	31	32½	75c qu. Aug. 1
Bessemer L. & C. 1st 6½'s[4]	10- 4-29	91	93	
Bloomington Limestone 6's[29]	10- 9-29	.....	87	
Boston S. & G. new com.[47]	10- 4-29	19	22	40c qu. July 1
Boston S. G. new 7% pfd.[47]	10- 4-29	48	52	87½c qu. July 1
Calaveras Cement 7% pfd.	10- 3-29	86⅞	.....	
Calaveras Cement com.	10- 3-29	20⅜	21	
Canada Cement com.	10- 8-29	24¾	25	
Canada Cement pfd.	10- 8-29	97	97½	1.62½ qu. Sept. 30
Canada Cement 5½'s[48]	10- 7-29	98	99	
Canada Cr. St. Corp. 1st 6½'s[32]	10- 4-29	96	99	
Can. Gyp. & Alabastine (new).	10- 8-29	27¾	28	37½c Oct. 1
Certainteed Prod. com.	10- 8-29	26⅛	26½	
Certainteed Prod. pfd.	10- 7-29	60	70	1.75 qu. Jan. 1
Cleveland Quarries new st'k.	10- 7-29	64	70	50c&25c ex. Sept.1
Columbia S. & G. pfd.	10- 8-29	86½	90	
Consol. Cement 1st 6½'s, A[42]	10- 9-29	90	95	
Consol. Cement 6½% notes[24]	10- 9-29	85	90	
Consol. Cement pfd.[29]	10- 9-29	50	60	
Consol. Oka S. & G. 6½'s[42] (Canada)	9- 4-29	100½	102	
Consol. Rock Prod. com.[9]	10- 3-29	.....	10	
Consol. Rock Prod. pfd.[30]	8-23-29	.....	23	
Consol. Rock Prods. units[20]	7-27-29	52	53	
Consol. S. & G. pfd. (Can.)	10- 8-29	.....	87	1.75 qu. Aug. 15
Construction Mat. com.	10- 8-29	23	25	
Construction Mat. pfd.	10- 8-29	41	42	87½c qu. Nov. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	10- 3-29	94	98	
Coosa P. C. 1st 6's[29]	10- 9-29	48	53	
Coplay Cem. Mfg. 1st 6's[49]	10- 7-29	90	.....	
Coplay Cem. Mfg. com.[40]	10- 7-29	10	.....	
Coplay Cem. Mfg. pfd.[40]	10- 7-29	70	.....	
Dewey P. C. 6's[30] †(1942)	10- 9-29	100	.....	
Dewey P. C. 6's[30] (1930)	10- 9-29	98	.....	
Dewey P. C. 6's[30] (1931-41)	10- 9-29	96	.....	
Dolese & Shepard	10- 7-29	112	120	
Edison P. C. com.[39]	10- 7-29	10c	.....	
Edison P. C. pfd.[39]	10- 7-29	25c	.....	
Giant P. C. com.[2]	10- 7-29	15	25	
Giant P. C. pfd.[2]	10- 7-29	20	35	3½% s.-a. June 15
Ideal Cement, new com.[33]	10- 5-29	61	64	75c qu. Oct. 1
Ideal Cement 5's, 1943[33]	10- 5-29	97	100	
Indiana Limestone units[29] (5 shs. com. & 1 sh. pfd.)	10- 9-29	90	.....	
Indiana Limestone 6's	10- 8-29	78⅛	80¼	
International Cem. com.	10- 7-29	66½	67½	$1 qu. Sept. 27
International Cem. bonds 5's	10- 8-29	94½	94¾	Semi-ann. int.
Iron City S. & G. bonds 6's[49]	9-20-29	85	90	
Kelley Is. L. & T. new st'k.	10- 7-29	44	45	62½c qu. Oct. 1
Ky. Cons. St. com. Voting Trust Certif.[48]	10- 4-29	13	14	
Ky. Cons. Stone 6½'s[48]	10- 4-29	95	100	
Ky. Cons. Stone pfd.[48]	10- 4-29	90	95	
Ky. Cons. Stone com.[48]	10- 4-29	13	14	
Lawrence P. C.	10- 7-29	50	75	$1 qu. Sept. 28
Lawrence P. C. 5½'s, 1942	9- 6-29	85	90	
Lehigh P. C.	10- 8-29	41	43	62½c qu. Nov. 1
Lehigh P. C. pfd.	10- 8-29	106¾	109	1¾% qu. Oct. 1
Louisville Cement	10- 7-29	250	.....	
Lyman-Richey 1st 6's, 1932[13]	10- 4-29	96	99	
Lyman-Richey 1st 6's, 1935[13]	10- 4-29	95	98½	
Marblehead Lime 6's[14]	10- 4-29	97	100	
Material Service Corp.	10- 8-29	29	30¼	50c qu. Sept. 1
Medusa Portland Cem.[29]	10- 9-29	120	125	1.50 Oct. 1
Mich. L. & C. com.[6]	10- 7-29	35	.....	
Missouri P. C.	10- 8-29	39	39¾	50c qu. Aug. 1
Monolith Midwest[9]	10- 3-29	8½	10	
Monolith bonds, 6's[9]	10- 3-29	97	98	
Monolith P. C. com.[9]	10- 3-29	14	14½	40c s.-a. July 1
Monolith P. C. pfd.[9]	10- 3-29	9	9½	40c s.-a. July 1
Monolith P. C. units[9]	10- 3-29	32	33½	
National Cem. (Can.) 1st 7's[29]	9-25-29	97	100	
National Gypsum A com.	10- 7-29	12	14	
National Gypsum pfd.	10- 7-29	50	54	
Nazareth Cem. com.[26]	10- 4-29	20	25	
Nazareth Cem. pfd.[26]	10- 4-29	100	106	
Newaygo P. C. 1st 6½'s[29]	10- 9-29	101¼	.....	
New Eng. Lime 1st 6's[14]	10- 4-29	97	100	
N. Y. Trap Rock 1st 6's	10- 8-29	95½	.....	
North Amer. Cem. 1st 6½'s	10- 8-29	58⅛	59⅛	
North Amer. Cem. com.[29]	10- 9-29	4	7	
North Amer. Cem. 7% pfd.[29]	10- 9-29	.....	30	1.75 qu. Aug. 1
North Amer. Cem. units[29]	10- 9-29	.....	34	
North Shore Mat. 1st 5's[18]	10- 9-29	95	.....	
Northwestern States P. C.[37]	7-26-29	140	.....	2% Oct. 1
Ohio River Sand com.	10- 7-29	28½	30	
Ohio River Sand 7% pfd.	10- 7-29	100	102	
Ohio River S. & G. 6's[16]	10- 7-29	90	95	
Pac. Coast Agg. 6½'s	8-29-29	99	.....	
Pac. Coast Agg. 7's	8-29-29	99	.....	
Pac. Coast Cem. 6's. A[5]	9- 6-29	.....	95	
Pacific Lime Co. pfd.[43]	9- 6-29	No market		
Pacific P. C. com.	10- 3-29	25¼	.....	
Pacific P. C. pfd.	10- 3-29	73⅜	81	1.62½ qu. Oct. 5
Pacific P. C. 6's[5]	9- 6-29	94½	100	
Peerless Egyp'n P. C. com.[21]	10- 4-29	2	3	
Peerless Egyp'n P. C. pfd.[21]	10- 4-29	84	88	1.75 Oct. 1
Penn-Dixie Cem. 1st 6's	10- 8-29	69¼	70	
Penn-Dixie Cem. pfd.	10- 8-29	40¼	42	1.75 qu. Sept. 15
Penn-Dixie Cem. com.	10- 8-29	8	8¼	
Penn. Glass Sand Corp. 6's	9- 6-29	101	103	
Penn. Glass Sand pfd.	9- 6-29	113	115	1.75 qu. Oct. 1
Petoskey P. C.	10- 8-29	9¾	10½	1½% qu. Sept. 1
Riverside P. C. com.	10- 3-29	.....	30	
Riverside P. C. pfd.[9]	10- 3-29	96	.....	1.50 qu. Aug. 1
Riverside P. C., A[9]	10- 3-29	16	18	31¼c qu. Aug. 1
Riverside P. C., B[9]	10- 3-29	5	.....	
Santa Cruz P.C. 1st 6's, 1945	10- 3-29	108½	.....	6% annual
Santa Cruz P. C. com.	10- 3-29	95	.....	$1 qu. Oct. 1
Schumacher Wallboard com.	10- 3-29	13⅝	.....	
Schumacher Wallboard pfd.	10- 3-29	24½	26½	50c qu. Aug. 15
Southwestern P. C. units[44]	10- 3-29	275	.....	
Standard Paving & Mat. (Can.) com.	10- 8-29	.....	28¼	50c qu. Aug. 15
Standard Pav. & Mat. pfd.	10- 8-29	.....	91	1.75 qu. Aug. 15
Superior P. C., A	10- 3-29	41	43	27½c mo. Oct. 1
Superior P. C., B	10- 3-29	18	22½	
Trinity P. C. units[37]	7-26-29	142	150	
Trinity P. C. com.[37]	7-26-29	51	.....	
Trinity P. C. pfd.[29]	10- 9-29	110	115	
U. S. Gypsum com.	10- 8-29	82	82⅞	2% qu. Sept. 30
U. S. Gypsum pt. paid	10- 9-29	78	79	
U. S. Gypsum pfd.[29]	10- 9-29	124	127	1¾% qu. Sept. 30
Universal G. & L. com.[8]	10- 9-29	No market		
Universal G. & L. pfd.[8]	10- 9-29	No market		
Universal G. & L., V.T.C.[8]	10- 9-29	No market		
Universal G. & L. 1st 6's[8]	10- 9-29	No market		
Warner Co. com.	10- 5-29	51	53	50c qu., 50c ex. Oct. 15
Warner Co. 1st 7% pfd.	10- 5-29	100	105	1¾% qu. Oct. 1
Warner Co. 1st 6's[8]	10- 9-29	100	101	
Whitehall Cem. Mfg. com.[36]	10- 5-29	125	.....	
Whitehall Cem. Mfg. pfd.[36]	10- 5-29	98	.....	
Wisconsin L. & C. 1st 6's[15]	10- 9-29	95	.....	
Wolverine P. C. com.	10- 8-29	4	5	15c qu. Aug. 15
Yosemite P. C., A com.[9]	10- 3-29	5	6	

†$484,000 called for redemption at 103½ October 1.

[1]Quotations by Watling Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by Rogers, Tracy Co., Chicago. [4]Quotations by Butler Beadling & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Dillon, Read & Co., Chicago, Ill. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee Higginson & Co., Boston and Chicago. [11]Nesbit, Thomson & Co., Montreal, Canada. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Peters Trust Co., Omaha, Neb. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co., of Illinois, Chicago. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hoit, Rose & Troster, New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., Detroit. [22]Hemphill, Noyes & Co., New York City, N. Y. [23]Blair & Co., New York and Chicago. [24]A. B. Leach & Co., Inc., Chicago. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [32]A. E. Ames & Co., Toronto, Can. [33]Boettcher Newton & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [38]McFetrick & Co., Montreal, Que. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [41]Hornblower & Weeks, New York City and Chicago. [42]E. H. Rollins, Chicago, Ill. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Inc., Los Angeles, Calif. [45]Taylor Ewart & Co. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
American Brick Co. pfd., 13 sh.[6] (par 25)	24	.....
Atlantic Gypsum Products[6] com., 200 shares	$2 per share	.....
International Portland Cement Co., Ltd., pfd.	30	45
Rockland & Rockport Lime Co. 2nd pfd.[7] 13⅓ sh.	2⅞ per snare	.....
Rockland & Rockport Lime Co. com.[7] 14⅓ sh.	55c per share	.....
Seaboard P. C.[1] 6% bonds ($7,500) 7-1-27. July, 1910, and subsequent coupons attached	$10 for the lot	.....

Stock	Price bid	Price asked
Southern Phosphate Co.[6]	1¼	.....
Universal Gypsum com. free stk.[1] 300 shares	$75 for the lot	.....
Universal Gypsum com.[1] 153 shares (no par)	$51 for the lot	.....
Vermont Milling Products Co. (slate granules), 22 sh. com. and 12 sh. pfd.[6]	$1 for the lot	.....
Winchester Rock Brick Co., pfd., 1 share (par $25) and 1 share com. (par $10)[6]	$8 for the lot	.....

[1]Price obtained at auction by Adrian H. Muller & Sons, New York. [6]Price obtained at auction by Wise and Arnold, Boston, Mass., June 19, 1929. [7]Price obtained at auction by R. L. Day & Co., August 21, 1929.

Monolith Portland Cement Statement for First Six Months

THE FOLLOWING STATEMENT has recently been issued covering the operations of the Monolith Portland Cement Co., Los Angeles, Calif., for the six months period ending June 30, 1929. In making this report President Coy Burnett stated that it does not cover the operations of the Monolith Portland Midwest Co., Laramie, Wyo., which started its plant last spring. The half year showing of the Monolith Portland Cement Co., exclusive of the Midwest company, compares with earnings for the entire year of 1928, when net profits available for dividends totaled $375,780.20, equal after preferred dividends to $1.71 a share on 150,000 common shares outstanding.

Net sales	$1,534,985.26
Cost of cement sold:	
Labor, supplies, royalties and plant expenses	$ 915,621.28
Provision for depreciation and amortization of leasehold on limestone deposits, based on appraised value	124,146.46
Total	$1,039,767.74
Gross profits on sales	$ 495,217.52
Selling and administrative expense	208,742.88
Net profit on operations	$ 286,474.64
Interest received and other income (net)	26,309.63
Profits before interest charges and federal income tax	$ 312,784.27
Deduct:	
Interest charges and amortization of bond discount and expenses	$ 18,333.33
Provision for federal income tax	34,192.44
	$ 52,525.77
Net profits	$ 260,258.50
Add back: Depreciation and depletion charges on excess of appraised values of plant, equipment and limestone deposits over actual cost values	47,473.54
Net profits available for dividends	$ 307,732.04
Preferred stock dividend requirements	60,000.00
Balance available for common stock	247,732.04
Per share	*1.10
Common stock outstanding, shares	225,000

*At annual rate of $2.20 per share on common stock.

Cleveland Builders Supply Co. to Change Capital Structure

FOLLOWING announcement of plans by the Cleveland Builders Supply and Brick Co. to change its capital structure by segregating its realty holdings into a realty company and shrinking the capital of the operating company from 240,000 to 80,000 shares, it was indicated yesterday that dividends of $6 a share would be paid on the operating stock if precedent is to be followed. In past nine years company has paid dividends averaging $480,000 a year. As the company's excess real estate is disposed of the proceeds will be disbursed in liquidating dividends. In the exchange of stock holders will receive one share of operating stock and two of realty for each three shares of present stock.

The Cleveland company operates two sand and gravel plants producing a total in excess of 200,000 tons annually in addition to retail establishments.

Alpha Cement Earnings

THE Alpha Portland Cement Co. reports for 12 months ended June 30, 1929, net income of $2,375,368 after depreciation and federal taxes, equivalent after 7% preferred dividend requirements, to $3.14 a share on 711,000 no-par shares of common stock.

Consolidated income account for 12 month ended June 30, 1929, follows: Net sales, $13,424,100; operating expenses, $9,741,568; depreciation, $1,254,313; operating profit, $2,428,219; other income, $274,169; total income, $2,702,388; federal taxes, $327,020; net income, $2,375,368; preferred dividends, $140,000; common dividends, $2,133,000; surplus, $102,368.

Consolidated balance sheet of Alpha Portland Cement Co. as of June 30, 1929, compares as follows:

ASSETS

	June 30, '29	Dec. 31, '28
*Property account	$22,480,305	$22,552,772
Cash	2,301,486	2,585,988
Call loans	2,000,000	2,800,000
U. S. government bonds	1,357,975	1,357,975
Work funds and advertisements	158,860	186,744
Accounts and notes receivable	1,190,608	557,110
Inventories	2,799,995	2,848,269
Miscellaneous investments	220,967	212,166
Deferred charges	528,136	367,063
Total	$33,038,332	$33,468,087

LIABILITIES

Preferred stock	$ 2,000,000	$ 2,000,000
†Common stock	24,134,500	24,134,500
Accounts payable	532,884	447,723
Wages payable	97,677	46,955
Federal tax reserve	319,523	404,475
Dividends payable	533,250	533,250
Insurance and other reserves	775,207	727,716
Earned surplus	4,645,291	5,173,468
Total	$33,038,332	$33,468,087

*After depreciation, depletion, etc.
†Represented by 711,000 no-par shares.

The Alpha company's common stock has been recently listed on the New York Stock Exchange.

Australian Cement Earnings

FOR THE YEAR ENDED November 30, 1928, Australian Cement Ltd., earned net profit of £94,602, a decrease of £6,213 over that reported for the same period ending November 30, 1927. The decline was attributed by the board to smaller sales consequent upon general slackness in trade in Victoria, especially in the building industry, and to increased competition for the business available.

In its report the board suggested that there is over-production in the industry, and that the announcement of additional works in New South Wales tends to make the position critical.

For its last completed trading year the company pays 10% dividend which requires £70,000, transfers £20,000 to reserves, and carries forward £34,306.—*Sydney* (Australia) *Sun.*

Lime Rock Railroad to Extend Maturity of Mortgage Bonds

THE LIME Rock railroad, a common carrier whose capital stock is owned principally by the Rockland and Rockport Lime Corp., New York, has been authorized by the Interstate Commerce Commission to extend from July 1, 1929, to February 1, 1940, the maturity of $400,000 of first mortgage bonds.

These bonds matured on July 1, 1929, and the Lime Rock railroad stated that it was unable to pay them at maturity or to refund them by another issue of bonds on terms as favorable to it as the proposed extension.

The principal holders of the bonds and the owners of over 50% of the outstanding bonds agreed on the terms of extending the maturity. A supplemental indenture of the extension provides that no dividend shall be paid on the capital stock unless and until all the bonds and the interest thereon have been paid, with the proviso that when the applicant shall have paid to the trustee for the sinking fund an amount in excess of the minimum requirement of $4000, the applicant may, with the approval of the trustee, pay dividends to an aggregate amount not exceeding the payment to the sinking fund in excess of $4000.

The Rockland and Rockport Lime Corp., as a party to the indenture, for itself, its successors and assigns, will unconditionally guarantee to the holders of the bonds as extended the payment of the principal and the interest thereon.—*U. S. Daily.*

U. S. Gypsum on Los Angeles Curb

THE board of governors of Los Angeles Curb Exchange have approved listing of 1,140,541 shares of $20 par common stock of U. S. Gypsum Co.

Consumers Co. Plan Approved

STOCKHOLDERS of Consumers Co., Chicago, Ill., at special meeting, approved an increase in common stock to 3,000,000 shares $5 par, from 1,000,000 shares and issuance of not exceeding $10,000,000 debentures to bear interest at not more than 7% and carrying common stock voting trust certificates purchase warrants. This additional financing is to take care of the absorption of several building material producing properties.

Recent Dividends Announced

Construction Mat. pfd. (qu.)	87½c, Nov. 1
Ideal Cement Co. com. (qu.)	75c, Oct. 1
Lawrence P. C. (qu.)	$1.00, Sept. 28
Penn. Glass Sand pfd. (qu.)	2%, Oct. 1
Northwestern States P. C.	$1.62½, Oct. 5
Pacific P. C. pfd. (qu.)	$1.75, Oct. 1
Peerless Egyp. Cem. pfd.	$1.75, Oct. 1
Petoskey P. C. (qu.)	1½%, Sept. 1
Superior P. C. "A" (mo.)	27½c, Oct. 1

Safety in Quarries, Crushing Plants and Cement Mills

THE annual meeting of the Cement Section of the National Safety Council was held in Chicago on Tuesday and Wednesday, October 1 and 2. In point of attendance the meeting fell short of previous years, but the program was perhaps more constructive than any which preceded it. While somewhat less than a hundred persons were present, the registration list is quite a complete roster of the safety leaders of the industry in the East and Middle West.

Annual Election

At the annual election the following officers were elected: General chairman, E. H. Parry, Glens Falls, N. Y., safety director and chief of personnel of the Glens Falls Portland Cement Co.; vice-chairman, R. B. Fortuin, Nazareth, Penn., assistant to the general manager of the Pennsylvania-Dixie Cement Corp.; secretary, A. J. R. Curtis, Chicago, secretary of the committee on accident prevention of the Portland Cement Association; chairman, program committee, W. L. White, Jr., Cleveland, Ohio, general superintendent, Medusa Portland Cement Co.; chairman, membership committee, H. A. Reninger, Allentown, Penn., special representative, Lehigh Portland Cement Co.; chairman, engineering committee, S. Henry Harrison, Phillipsburg, N. J., assistant superintendent, Vulcanite Portland Cement Co.; chairman, committee on slides, safety kinks and posters, David Adam, Northampton, Penn., safety engineer, Lawrence Portland Cement Co.; editor, Section News Letter, Jack Dempster, Port Colborne, Ont., in charge safety work, Port Colborne mill, Canada Cement Co., Ltd.

Maj. H. A. Reninger

F. E. Town

The retiring chairman of the cement section, F. E. Town of Manitowoc, Wis., presided at the sectional sessions, while R. E. Colville, chairman of the quarry section, presided at the joint session of cement and quarry sections and J. B. John, chairman of the committee on accident prevention and insurance of the Portland Cement Association, presided at the joint luncheon of the two sections. **Chairman Town** opened the first session of the cement section with the following address (in part):

Chairman Town's Address

"This year's meeting carries with it greater interest than usual for we have been honored by having the president of the Council, Major Reninger, chosen from our section. Major Reninger has filled this important office with credit and honor to himself and his fellow safety workers in the cement industry. Since Major Reninger was elected president the membership of the Council has increased from 4576 to 5175, a net gain of about 55 members per month.

"At the beginning of this year the cement section had a membership of 90 companies. At present there are 88 companies holding membership. There have been four new members added and six cancellations, all of these on account of consolidations.

"During the year just closing we have been privileged to participate in 14 regional safety meetings conveniently located throughout the United States. In carrying these meetings almost to the door of the plants, a much larger number of the mill men were able to share in the benefits than was possible when our safety meetings were limited to those held in connection with those of the Portland Cement Association in Chicago and New York and the National Safety Congress. Many of the programs at the regional meetings have been of highest quality and those who attended have gone away with renewed interest and enthusiasm.

Fatalities Increasing

"The decrease of lost-time accidents every year has been very marked, but the severity of accidents, length of disability and number of fatalities has been increasing at an alarming rate. Nor have the fatality cases predominated among men new in the industry, but figures show that it is often the old timer who is paying the penalty, either of his own or some one else's carelessness. I assume you have all read the significant accident bulletins for July and August issued by the Association, reporting this situation in detail. There were nine fatalities during August, the greatest number for any month in our history.

"The less serious accidents continue to decline clearly showing that in the main the men have reached a high standing

E. H. Parry

W. L. White, Jr.

of safety observance and safe conduct. But apparently the more serious accidents cannot be reduced until the plant managements have more earnestly sought out every detail of these accidents and then left no stone unturned to eliminate every cause whatever it may be, holding every man properly responsible for any contributing causes. The condition has become so serious that I hope we will reach a definite understanding that will enable us to blot out total disabilities and fatal accidents or at least greatly reduce their rates."

Screw Conveyor Accidents

Following Chairman Town's address, the meeting launched into a technical discussion of one of its most cruel and persistent types of accident—those due to workmen falling into screw conveyors. The subject was introduced through a paper by **M. S. Humphryes,** mechanical engineer of the Universal Portland Cement Co., Chicago, describing the mechanical construction of conveyors in use in the Universal plants and the general rules applying to their operation. The following is an excerpt from Mr. Humphreyes' paper:

"One of the most common and effective means of transporting the different materials that go to make portland cement is the screw conveyor. This device is particularly dangerous to human life and limb and from the earliest days of its use has contributed heavily to the record of accidents in the cement business, many of which have ended fatally.

"During the past decade very careful attention has been given to this device, with the idea of eliminating all the dangerous features and making it as safe for the workman as human science will permit.

How to Eliminate Dangerous Features

"In solving the problem of screw conveyor accidents there are three important facts to be considered.

"1—The mechanical construction of conveyors and covers.

"2—Safety appliances applicable to the employe.

"3—Good housekeeping and safety education of the employe.

"The mechanical construction of conveyors is shown in the accompanying figures which illustrate the standard construction of conveyors as developed and used in the plants of the Universal company. There are in general three types.

"Fig. 1 shows the construction used for standard installations, that is, for all ordinary uses and at points readily accessible for its operation and maintenance. This type is built so that the cover will fit over angles fastened to the box proper, like the lid of a box or pail. This allows the dust to be retained by the angles and forms a seal that prevents dust leakage into the atmosphere. Straps are riveted to the cover at convenient points, usually two to a cover, and through the ends of these straps, bolts are placed to hold the covers down tight to the conveyor box and hold it securely against removal under ordinary circumstances and yet presents the minimum of labor required in removal for repairs. The covers are normally made about 4½ ft. long which makes them easy to handle.

"Fig. 2 shows the construction used in tunnel installations where the head room is limited. In this type the flat cover is bolted directly to the conveyor box every 12 in. and necessarily requires more labor and time in making repairs.

"Fig. 3 shows the construction used in special cases where it is essential to have a large area over the screw conveyor for ventilation purposes and this space is very

M. S. Humphryes

effective in eliminating dusty conditions around a cement mill, especially when connected to a dust ventilating system. The cover used on this type can be the same as that used in Figs. 1 or 2, depending of course on the conditions surrounding its installation. Our experience has proven that these types of construc-

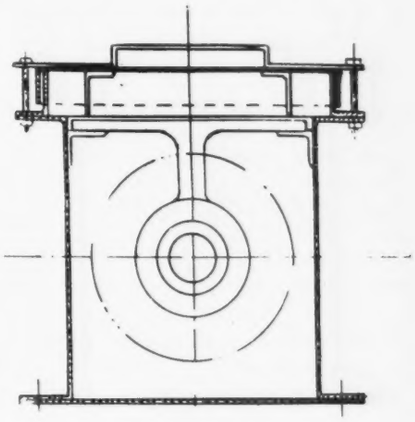


Fig. 1. Construction for standard installation

tion are very effective in providing a safe means of conveying materials, reducing screw conveyor accidents to the minimum.

Safety Appliances

"There are many appliances which may be used for the safety of employes without detriment to good operation. A few suggestions of this kind follow. When it is necessary to shut down a conveyor for repairs the first act of the handyman after

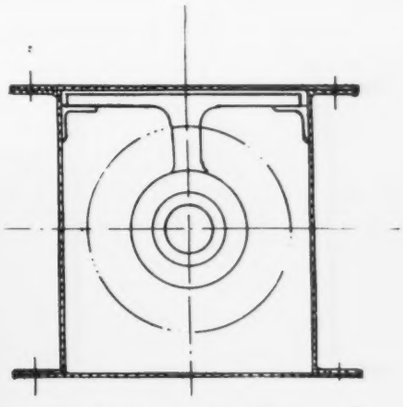


Fig. 2. Construction for tunnel installation

the switch is thrown is to place a padlock, with which every man is supplied, on the motor switch so that the motor cannot be inadvertently started by another employe, not knowing that the conveyor is down for repairs. This rule is strictly enforced and is applicable to all types of machines that are shut down for any cause whatever, either mechanical, electrical or operating.

"Where it is necessary to return the spillage and sweepings from the floor to

the conveyor, for return into the process, an opening is cut in the cover around which an angle retaining ring is placed and into the opening is bolted a screen or grating of such design that it is impossible for an employe to get his hand or foot through it; a cover is then placed over the opening like the cover on a pail, which is easily removable. This construction is shown in Fig. 5. In this way a convenient and safe method is provided for clean up without removing the main cover of the conveyor box which would introduce a serious hazard.

"Sampling from conveyors while in operation is prohibited and where it is necessary in the process to take samples, special sampling devices are provided, these have proved effective in eliminating accidents.

"In silos and bins where it is necessary at times for men to enter, the screw conveyor hazards have been eliminated by placing the conveyor below the floor level, the same being connected to the bin by means of spouts through the floor. This construction will not allow the entrance of the human body beyond the safety point should the workman accidentally fall near or into the spout.

"Good housekeeping and safety education are most essential to the safety of the employe. The practice of allowing

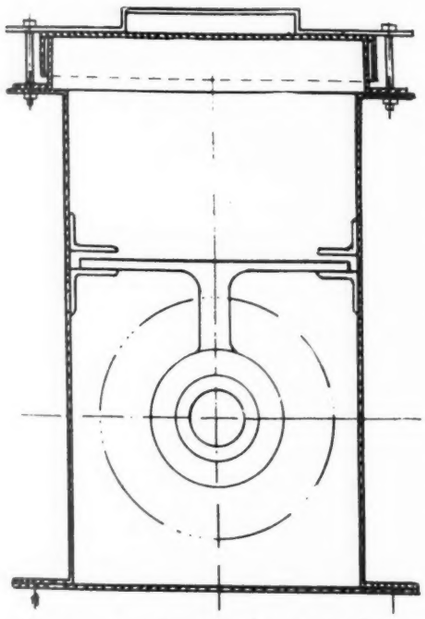


Fig. 3. Construction for dust chamber type to be used where large area is required for dust ventilation

dirt and rubbish to accumulate in large or small quantities on conveyor boxes and lids and around the floors is strictly prohibited as these not only present an untidy condition, but offer an obstruction to stumble over and often conceal defective or loose conveyor covers.

"Clean surroundings encourage the workmen to wear better clothing and inspire him to do better work, more safely, and such a condition will surely show an increase in man power production.

"The personal safety of the workman

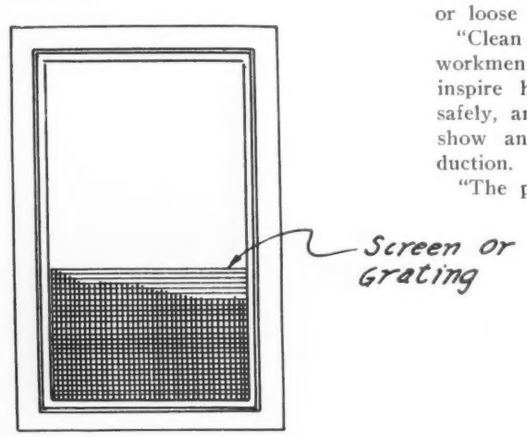
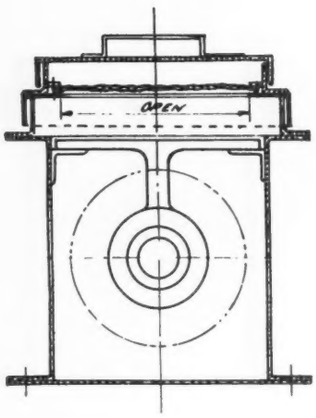
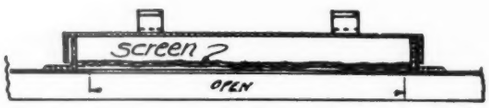


Fig. 5. Safe and convenient method of constructing clean-up door in cover of conveyor





is based on plant spirit and plant safety. In order to teach him to work safely he first must be sold on the company for which he is working, he must have the plant and safety spirit and must co-operate and have the co-operation of his fellow employes.

"Once a workman has the spirit, he is ready to accept safety at its true value, to be educated and schooled along the lines of safety and to put forth all his efforts toward that end. He must be wide awake and alert at all times, and he will think twice before placing his hands or any part of his body near a moving conveyor or allowing a fellow employe to do so."

Mr. Humphreyes' paper is of unusual interest because the Universal company employs a relatively large number of screw conveyors and nevertheless enjoys a safety record almost unblemished by conveyor accidents.

The Surgeon's Part

Dr. J. L. Rock of Oglesby, Ill., plant surgeon for the Lehigh Portland Cement Co. and the Marquette Cement Manufacturing Co., opened a discussion on "The Surgeon's Part in Accident Prevention" with an admirable paper on the subject

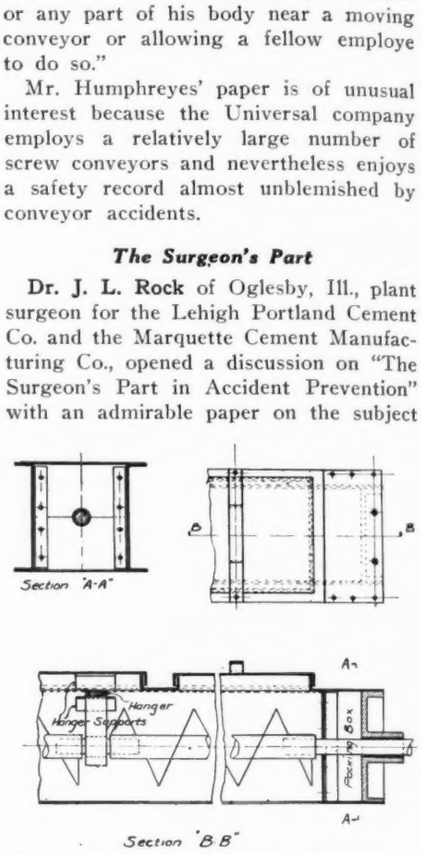


Fig. 4. Section through a screw conveyor

which, for brevity, has been excerpted as follows:

"My investigations indicate that most of the cement mill surgeons attend to only the treatment of injured employes, giving little or no attention to other phases of industrial medicine which are so closely entwined with the safety movement. Therefore, I am going to attempt to show you that a competent surgeon and his department can materially aid in accident prevention.

Selection of the Doctor

"The selection of the doctor is of prime importance. His training, character, and personality should be investigated and one with industrial experience should be selected. Many of the larger industries have a number of these specially trained medical men working for them. True, they haven't had special training in the cement industry, but the medical work for all industries is much the same, and a good man can easily adjust himself to the cement mill conditions in a very short time. I offer as a suggestion, in selecting a surgeon, that the chief surgeon of one of these larger companies be consulted with a view to locating a young doctor that has benefited by his training and would be competent for cement mill

work. First, I, personally, would prefer a young man in the profession not over two or three years out of school. He is still in the making and possibly, more enthusiastic and ambitious, and could more readily adjust himself to conditions of cement mill. Second, a man who is a graduate of an A class medical school. Third, one who has had a good hospital interneship. The hospital is the place where one learns the practical side of surgery and medicine. There are a few things a doctor coming from a good hospital interneship cannot do, but he will soon adjust himself to his new conditions. Fourth, one who is in good physical condition. His ambition is keener, he will work harder, and sets a good example to the people he is going to work among.

"I am convinced that where the cement company is sufficiently large, and by that I mean 250 employes or more, it would be valuable to have a trained nurse as a part of the medical department. Her office hours should be much more frequent during the day than the doctor's, or if possible, all day long. She should do all the first-aid dressings. I find that with a nurse, more cases reach the doctor and fewer cases of infection develop. She has developed that sense of surgical cleanliness which is impossible to develop in the first aider, and for this reason, too, fewer cases of infection develop. The first-aid room is cleaner and is kept looking more like a hospital room, with less chance for infection. Then, in the matter of supplies, the nurse will effect savings by making dressings that otherwise would have to be purchased at greater cost.

Plants Should Have First-Aiders

"There are first aiders and first aiders, but not so many are really efficient. Every employe in the plant should have first aid training for his own safety. It teaches the employe to be more careful, and therefore less likely to neglect small injuries. In the absence of a nurse, there should be a well trained first-aid man on duty all the time at the first-aid room. He should be trained by the doctor and taught the value of asepsis in the matter of dressings. The first aider should do the dressings and in the absence of the doctor, should arrange for all patients to return when the doctor is present.

"Each plant should have a well equipped first-aid room. I have tried out the method of having first-aid boxes or stations in each department, and find that they are not very successful. It is impossible to get a real first-aid man to look after these stations, especially where the department operates on shift basis. Poor first-aid work is worse than none at all. I found that all men ran to the first-aid box and helped themselves, thus disarranging, using wrong materials, and causing the materials to become dirty and surgically unclean. I believe a bottle of boric acid solution should be kept in each department, especially the loading. When a man gets a "shot" of cement in the eye it should be used to immediately wash out the eye. This neutralizes the alkaline reaction of the cement, and thereby lessens the irritation which, if allowed to remain until he reaches the first-aid room, would add many days to his disability.

"The plant surgeon should spend a certain definite period at the plant each day. At that time all injuries given first aid in the interval since his last visit will be seen by him, as well as the more severely injured that report daily. Some cases, if sent to the surgeon's office, would never reach it; a man, after reaching home, dislikes to get out again; hence, the small injuries are often neglected.

Periodical Physical Examinations

"Every man on being employed, should be given a physical examination by the plant surgeon. All defects should be noted and a record kept of them. These defects should not necessarily keep the man from working, and this examination would enable the employment department to place the applicant where his physical defects would not affect his safety or that of his fellow workmen. A man, for instance, with heart trouble should not be placed to work around machinery where there would be a danger of his falling into it.

"I do not believe a man with a hernia should be employed. The work about a cement plant is such that it predisposes to a strangulation while on duty, which renders the company liable. Then again, the hernial operation is so successful now-a-days that no man should be encouraged to neglect it. In the matter of eyes, each employe should be examined thoroughly. If his eyes test half vision or less, the employe should be sent to an eye specialist and fitted with glasses before being allowed to work.

"I believe that every employe should be given a physical examination periodically, say, every six months and not less than once a year. The physical examination gives the company an invaluable check as to the physical fitness of the employe and the physical defects, if treated, might save a lost time accident.

"In the matter of treatment I am not going to say much except that a doctor should institute all the most modern and up-to-date treatment that is available. He should not hesitate to discard an old treatment for something new if better. He should keep up to date by reading, and especially by attending clinics. I believe the doctor should attend industrial clinics at least once a year, and oftener if possible. In Illinois we have a state industrial society which meets twice a year, and these meetings are of the greatest benefit to the industrial surgeon. Here all the latest and up-to-date industrial proplems, treatments, etc., are discussed. A company should insist that its surgeon attend these or like meetings, and encourage him in doing so.

Keep Man on Job Whenever Possible

"Many cases would lose time unless told not to by the doctor. A great many of these cases which at first would seem lost time accidents can be kept at light or easy work. It is usually not hard to get a man to work in the first week of a lay-off. He is restless and doesn't know what to do with himself. But let him lay off longer than a week and he becomes accustomed to it. Then it becomes increasingly hard to get him back to work the longer he stays away. The doctor should communicate with the employment department immediately on all these cases, so that it can arrange a light job for him. Often-times a man's own job can be done by him, by having his helper do the heavier work. All of this can readily be arranged by the doctor talking it over with the employment department. The company is not losing anything by having the man work at these easy jobs. It would have to pay him half-time anyway and most any employe will do more than a half man's work. I believe that there should almost never be a loss of time due to an injury of the upper limbs. Of course, the lower limbs support the body and here there will be a greater loss of time.

"In the matter of infections I almost insist that they stay on the job unless they are hospital cases. I have found that they can be cleared up very promptly by continuous or almost so, hot boric applications, and the only way I can get these, unless in the hospital, is by having them report to the first-aid department four or five times per day. They will not follow out directions at home. Even if very little work is done it is made up for by losing less time, and having no permanent disability after.

"First-aid instructions should be given at the plant, and I know of no one more qualified to do it than the doctor. It should be the aim to have every man in the plant a first-aid man eventually. I believe all the foremen should be given a rigid course in first aid, first. The foreman as a rule is better qualified mentally to receive this work than the ordinary workman."

Dr. Ogden's Discussion

Following Dr. Rock's paper **Dr. C. E. Ogden** of the medical staff of the Universal Portland Cement Co. led an interesting discussion of the subject. Dr. Ogden said in part:

"Dr. Rock has ably outlined the medical department and its personnel and the functioning thereof. I was particularly impressed with his stressing of the importance of the personality and character of the personnel. The professional qualifications we can find; the special training they can get; but persons with tact, judgment and a sense of responsibility are the greatest asset to the organization.

"Briefly summarizing Dr. Rock's paper,

we find the doctor's role in accident prevention threefold:

"1. Reduction or elimination of the temporary and permanent disability in accidents.

"2. Physical examinations.

"3. Preventative medicine in sanitation and occupational health hazards.

"Dr. Rock's experience that the placing of first-aid kits in the different departments and the training of certain workmen in their use was wholly unsatisfactory, forcibly confirms our belief in this respect.

Report All Accidents

"It has been an ironclad rule with us that all accidents, even to the most trivial scratch, shall report to the dispensary for treatment and that a complete record be made in each instance. This record has, in many trivial cases, seemed irksome to all involved, but its importance in correcting delay in reporting for treatment and in those cases which later show infection or aggravation, and in those cases which at a later date become compensation claims, is forcibly brought home. Then we are able to establish the original injury, its origin and course.

"One of our reports which has been invaluable is the *'Delayed Treatment Report.'* This is a daily report compiled each evening, in triplicate, showing the time, date, nature of claimed injury, date and time of reporting to the dispensary, patient's name, check number, department and foreman's name. The report is rendered to the general superintendent and the manager of the safety department, the latter taking it up with the man's foreman the next day. You may readily see its value in

1. Reducing the number of infections.

2. Impressing the foreman and men with the importance of getting the trivial injuries *immediately to the dispensary.*

3. Placing the responsibility directly on the foreman of his men reporting for treatment.

"With the close co-operation of medical and safety departments, we have seen time lost accidents cut down to what would seem a minimum, with plants establishing records of over 400 days with no time lost accidents.

"I am probably 'bearding the lion in his den' when I ask that in a zealous effort to hold and increase these 'non-stop endurance flight' records that the followng items represent the determining factors in those cases which ordinarily would lose time from their regular occupation were not light work found for them:

Determining Factors for Injuries

"1. Will the temporary disability (i. e., time lost from regular occupation) be prolonged or the permanent increased, if this man returns to work with 'no lost time'?

"2. The doctor shall be the sole determining judge and on the merits of the individual case.

"3. The same zealous effort shall be made to get these cases to work who, for the above reasons have lost one or more days at the time they come within the scope of these axioms.

Doctor's Work in Prevention

"We have two roles in accident prevention which are somewhat diametric: "(1) Physical examinations at the time of employment are made with a view of eliminating those physically unqualified for the particular work for which they were hired, and as a record of those physical defects which might later be claimed as the result of accident or employment. (2) Periodic physical re-examinations are not made with the idea of eliminating all but the perfect from our employment, but must be made with the idea of conserving and prolonging the efficiency of the employe and they must be of equal value to the employer and employe. The object of this examination is primarily to discover and correct physical conditions, the symptoms of which and the disability therefrom, have not been sufficient to have taken the employe to his doctor.

"With the reduction of accidents, the doctor's role in prevention should be enlarged and developed along the lines of preventive medicine. Tangible results in hygienic fields are perhaps best obtained by educational activities either in plant papers or by bulletins or on posters. The common cold, influenza, smallpox vaccination, heat prostration, are but examples coming under this heading. The encouragement of personal confidential interviews of the more intimate problems, will correct many a potential hazard.

"To attempt to discuss ways and means of correcting occupational health hazards, would take hours but I wish to leave this—that practically every occupational health hazard may produce a specific occupational disease and that an aggravation of a latent disease may be partially occupational and become compensable.

"The following classification by Dr. Hayhurst in the July, 1929, monthly *Labor Review* of the United States, Department of Labor, gives us the etiological fields along which lines our efforts should be directed:

"1. Specific Occupational Diseases:

1. Poisonings.
2. Mechanical irritations.
3. Infections.
4. Occular affections.
5. Noise deafness.

"2. Partially Occupational:

1. Respiratory.
   a) Silicosis
   b) Asthma
   c) Tuberculosis
2. Circulatory.
3. Nervous Disorders."

Wednesday morning's session opened with a paper by **J. J. Forbes,** supervising engineer, U. S. Bureau of Mines on "First-Aid Training" which logically followed the interesting contributions of Dr. Rock and Dr. Ogden.

An extract from the paper written jointly by Mr. Forbes and R. D. Currie, associate mining engineer, U. S. Bureau of Mines, and read by Mr. Forbes, is given in part as follows.

First Aid Training

"The first-aid course as prescribed by the Bureau of Mines consists of 15 hours' instruction consisting of lectures and practicum. It goes into details on the anatomy of the human body, the respiratory system, the vascular system, and the nervous system. Instructions are given in carrying for the injured, in artificial respiration, control of bleeding, dressings for open wounds, dressings for fractures and dislocations, dressings for burns, treatment for shock, and transportation of the injured.

"At the completion of the course, which generally requires five lessons of three hours each, the Bureau of Mines issues a certificate to those who have successfully completed the course. Since 1910 and to July 1, 1929, 316,421 certificates have been issued.

"In some states the state department of mines also issues certificates to miners trained in first aid by their instructors, and it is becoming a practice among some of the larger companies to issue company first-aid certificates to their employes who have been trained in the work.

"First-aid contests have been thought to be one of the best means for stimulating interest in first-aid training, and as a result many contests are conducted each year. These affairs are sponsored by the various companies, state departments of mines, the American Red Cross, and the United States Bureau of Mines. Probably the most outstanding of these competitive meets is the International Contest. Last year 46 teams from 17 different companies located in 11 states competed at this contest. In some cases these teams were selected as the best, through elimination contests, from 60 or more teams. Prizes, many of them elaborate, are offered at these contests for the winning teams.

The 100% Plan

"In the spring of 1923 a new idea in first-aid training was started at Thomas, W. Va., for the Davis Coal & Coke Co. This is known as the 100% plan and consists of training every employee of a mine or plant. During the past year in which more than 79,000 men were trained in first-aid by the Bureau of Mines, about 40% of them were trained under the 100%, or cooperative plan.

"Under this plan a group of 'key-men'

are trained as instructors by the bureau. These key-men are employes who have been selected for their knowledge of first-aid, ability to teach, and ability as leaders. Their training as instructors generally requires two weeks of intensive work, at the end of which time the employes of the entire plant are divided into groups of 15 to 20 men and an instructor is appointed to each group. The instructors train their respective groups in the bureau's methods of first aid under the direct supervision of a bureau instructor. In this way large groups of employes can be given individual instructions in first-aid methods, and the results obtained are much better than where large classes are conducted by Bureau of Mines instructor alone.

"At the completion of the classes the groups are examined by the bureau men, and those who have passed the course are granted a Bureau of Mines certificate.

"There are several advantages in conducting the traing on the 100% plan, as follows:

"1. Competent instructors are provided for the plant.

"2. Small groups or classes assure individual attention.

"3. Large plants can be completly trained in a comparatively short time.

"4. An active spirit of cooperation and fellowship is sponsored by the plan.

"5. A nucleus of competent instructors is left at the plant, so that the interest in first aid does not leave with the Bureau of Mines rescue car or instructor, as is generally true under the other plan.

Cement Mills Adopt 100% Plan

"At the annual meeting of the Portland Cement Association held in Chicago in November, 1928, tentative plans for first-aid training of all employes in the plants of the Association were made by A. J. R. Curtis, assistant to the general manager of the Association, and D. Harrington, chief engineer of the safety division of the Bureau of Mines. This work was started in the early spring of 1929, and to July 1 a total of 6,795 men have been trained for the cement mills. This training was scattered over 26 states.

"During this campaign of first-aid training, eight plants were trained 100% and were awarded 100% certificates by the Bureau of Mines. Most of the training was done on the 100% plan so that members of this association are now quite capable of carrying on their own initial first-aid training. The bureau will gladly cooperate with plants of this association in examining classes trained by plant instructors for Bureau of Mines certificates.

"Some of the advantages to be expected from first-aid training are that:

"1. A man who has been trained in first aid is generally a safer man after receiving the training because he has been made to visualize serious personal injuries.

"2. A trained man is an asset to any plant because he can relieve an injured employee of much suffering; in some cases he can actually save life itself.

"3. Financial savings are generally realized through reduction in compensation and insurance payments."

Joint Sessions—Cement and Quarry Sections

"The first speaker at the joint session of the Cement and Quarry section, on Tuesday afternoon, was **Thomas J. Quigley,** chief of the quarry section Pennsylvania State Department of Labor and Industry, a quarryman and safety leader with many years of experience. In discussing 'Safe Practices in the Quarry' Mr. Quigley said in part:

"The first thing necessary for the reduction of accidents in any plant is that the management from the owner, president, general manager, or superintendent, down to the very last person in the plant must be thoroughly sold on accident prevention. Unless the management stands 100% back of the safety movement you cannot and will not reduce accidents. To sell safety or accident prevention to the owner, manager or superintendent of a plant sometimes requires real high class salesmanship, but if you cannot sell safety or accident prevention to the management, it is a waste of time to try to sell it to the foreman who has but one authority and one duty. His authority is limited to the hiring of men and his duty is to get out the tonnage. To try and sell safety to such a person is a waste of time and energy and no matter how enthusiastic the foreman may be he lacks proper support. When men and management stand 100% for accident prevention and the management demonstrates to the men that it means business and either discharges or disciplines men who violate safety laws, and safety rules or men who refuse to act safely or criticize the safety laws, then, and then only will you get real safety results. I have never known of a single case where the safety movement failed when the management was 100% back of it.

Most Accidents Preventable

"Accident statistics compiled both by the United States Bureau of Mines and the Pennsylvania Department of Labor and Industry show that 75% of all accidents are preventable, and by that I mean that 75% of all accidents which occur in industry can be prevented by a real safety organization in the plant and by safe practices. Five causes stand out conspicuously as representing about 75% of all our accidents. They are as follows:

"1. Falls of material.
"2. Falls of persons.
"3. Handling material by hand.
"4. Hand tools.
"5. Cars and engines.

"To eliminate from your minds any doubt as to the actual results obtained from plant safety organization, I will mention a few of the many remarkable records made by some of the quarries in Pennsylvania.

Some Excellent Quarry Records

"The No. 4 quarry of the Penn-Dixie Cement Co. at Nazareth, Penna., has operated over four years without a lost-time accident.

"The Pittsburgh Limestone Co. operated their St. Clair quarry two years and two months, at which time they celebrated the second year without a lost-time accident at the plant.

"The Lehigh Portland Cement Co. operated four plants in Pennsylvania during 1928 without a lost-time accident and was awarded four trophies by the Portland Cement Association.

"The General Crushed Stone Co. operated the White Haven quarry one year without a lost-time accident and was awarded the trophy of the National Crushed Stone Association.

"The John T. Dyer Co. operated its Monocacy quarry one year without a lost-time accident and many other quarries too numerous to mention have made similar records. This, in my opinion, is sufficient proof of what can be done to prevent accidents in quarries and the records made were accomplished only through real safety organizations, backed by real safety management.

Safety Pays Dividends

"That safety pays big dividends is admitted by all of the large concerns. I wish at this time to give you what I believe is one of the most outstanding records made by any quarry company from a standpoint of accident prevention, increase in production, and a decrease in the cost of production. One of our large quarry companies in Pennsylvania has a record of from 350 to 400 lost-time accidents per year over a period of five years. The president of this company was appealed to and he decided to start a safety campaign at once. The records show the following results:

12% decrease in accidents the first month.

24% decrease in accidents the second month.

48% decrease in accidents the third month.

64% decrease in accidents the fourth month.

88% decrease in accidents the fifth month.

"And the sixth month not a lost-time accident with one thousand men on the

payroll. The president of this company informed me that his production had increased with the decrease of accidents. He further informed me that one of his quarries in 1927 had an average cost of $187 per month for medical fees for treating injured employes and this same quarry from August 1, 1928, up to and including April 17, 1929, eight months and seventeen days, had an expense of only $19.50 for medical fees. Another one of his quarries with an average of $185 per month during 1927 went from August 1, 1928, to April 17, 1929, eight months and seventeen days, and paid out only $1 for medical fees, a saving of $1,481.50 in medical fees at the two quarries, and the company operates eight quarries."

Following Mr. Quigley's talk, **J. R. Davis,** assistant to vice-president, United States Gypsum Co., spoke on "The Hidden Costs of Injuries," from the executive's viewpoint. Mr. Davis, whos remarks were drawn from a long experience with the handling of accident prevention work, said in part:

Hidden Costs of Injuries

"It is my understanding that there is some antipathy to the use of the word 'costs' in connection with accident prevention work. As a matter of fact, I was cautioned to be diplomatic in my approach to this subject under penalty of being considered "hard boiled" and interested in accident prevention only because of the money involved.

"It is from the standpoint of an operator endeavoring to reduce waste and loss in operation that I wish to approach the subject of costs. Costs are the means of measuring results in production, so why not use them as a measure of results of accident prevention. As a matter of fact, the cost of injuries is a direct part of the cost of producing goods, and when we undertake to analyze costs of injuries, we are simply carrying the analysis of costs a little farther than is customary.

Costs of Injuries

"Our company carries its compensation insurance in three ways, through state insurance funds, with insurance companies, and by self-insurance. Regardless of the type of the insurance, or the premium paid, we figure the costs of all injuries in the same manner.

"Every accident which is severe enough to require more than first-aid attention is reported, and the cost of it is calculated. This cost includes in minor accidents, perhaps, only the doctor's fee, and may be an X-ray picture. In the more serious ones, where compensation is involved, it includes the compensation, the hospital bill, if any, and in cases of partial or permanent total disability and death, the cost includes the reserve set up to cover the future payments. These costs may later be adjusted as reserves are changed to meet conditions.

"During the month of August, we had 82 such accidents reported with a total cost of $7,843.02, or an average cost of $95.65. The costs ranged all the way from $2.50 to $5,700.

"Let me mention some from the list:

Mashed fingers in switch point	$950.00
Did not bar down loose rock—rock fell breaking ankle	161.00
Dropped running board on toe—broke toe	71.00
Pushed on pipe wrench with knee—bruising knee	10.00
Rock fell on hand—bruise	50.00
Blister on hand from shoveling	20.00

"This method of keeping costs of injuries is only one of the ways in which we record and study the results of our accident prevention work so that we can not claim that the reductions we have made are entirely due to our methods of keeping costs, but the results are at the very least illuminating.

"For the first eight months of 1929, as compared with the same period in 1928, we reduced the total cost of injuries 23% which was a saving of approximately $18,000.00. The cost per case was reduced 26%, and the cost per $100.00 of payroll was reduced 23%.

"An analysis of these reductions shows that while we had a slightly greater number of cases reported in 1929 than in 1928, the severity of these cases was very much less.

Rating the Plant

"The mere analysis of figures, however, does not produce results. Results can be produced only by bringing these facts to the attention of those responsible for the operations. Through a special rating plan which we have in operation in our company, each plant is given a standard cost per $100 of payroll. Each year a certain reduction is asked, based on their previous record and known conditions at the plant. The plant is then rated against this standard. This brings the costs before the men responsible and enables them to take the necessary action.

"In passing on to the question of hidden costs, I would like to say that we feel that all costs resulting from any injury are a part of the cost of that injury. There are some costs which are less easily determined than those we have mentioned, and these are commonly known as hidden costs. In many cases, they amount to more than the apparent costs, and it is for this reason that we are making an attempt to determine them.

Analyzing the Costs

"The hidden costs can roughly be considered under three classes. I have already spoken of the manner in which we report accidents. In this class of reportable cases, it is a little easier to get at the hidden costs, as we have something specific to deal with. A man is injured, the machinery stops, the men are idle. There is a loss of production, interest charges, taxes, insurance, supervision, and all the other items of overhead continue.

"Take for example a recent injury which occurred in one of our plants. A man was caught in one of our machines, resulting in an injury to his hand. Roughly, we estimated the hidden costs of this injury as follows:

Crew idle 1 hour	$35.00
Interest, etc., on investment	10.00
Fuel, power and other losses	10.00
Total	$55.00

"It so happened that this was a serious accident, and the incidental costs were only a small part of the total cost. We have had similar accidents, however, where the cost of the injury was under $5.00, and the incidental costs were ten or twelve times as great.

"The interest and similar costs of running a large shovel may run up to $10 or $15 per hour. It is easy to see how a minor accident in the quarry might stop a shovel for an hour, and while the injury might cost only one or two dollars, the indirect cost is far greater.

"I recall distinctly a fatality that occurred in a quarry under my direction, when the efficiency of the quarry force was, as they say, "all shot" for at least a week after the accident. That loss in efficiency as near as we could calculate it cost us $2.000.

"The second division I have made in classifying is that of the first-aid cases. A recent analysis of this type of case, at one of our plants for one month shows the following cost of the 147 cases treated:

1—147 × 15 min. lost time @ 50c hr.	$ 18.40
3—First aid supplies	30.00
2—First aid attendant	125.00
4—Heat, light and phone	10.00
5—Part time of doctor	75.00
6—10 X-ray treatments @ $2.00	20.00
7—Cost of records, reports, etc., and time investigating	34.07
8—Estimated damage to equipment	35.00
9—Loss of production, interest on investment, etc., estimated	10.00
Total	$447.47

Near-Accidents

"The third class are the 'near accidents,' those that do not result in any injury but which are potentially serious accidents. Very little is known about these at present, but we are making definite efforts to study all the near accidents not only from the standpoint of the cost, but from the standpoint of reduction in the loss of life and limb.

"Thus far, I have spoken of costs only as affecting the company. There are, however, costs to the men, and to society as a whole. The general rule is to pay the man two-thirds of his income as compensation so that he suffers an actual loss

of one-third during the period of time lost. Take one-half of your own compensation payments, and you will have roughly the cost to your employes for this item. In our company this would amount to $35,000 or $40,000 per year.

"In addition to the losses or cost to the men themselves, there are the losses to society as a whole. Take for example the fatal injury of a young man of 20 years. Normally, he could expect to live to the age of 64. Assuming his average productive effort is $2.000 per year, and multiply by the 44 years lost, and we find that society has been deprived of nearly $100,000 worth of productive effort."

Putting Punch Into a Safety Campaign

The last speaker at the joint session was **Jack Dempster,** well-known safety leader at the Port Colbourne (Ontario) plant of the Canada Cement Co. Mr. Dempster's paper was far deeper than its subject, "Putting Punch Into a Safety Campaign," might infer, focusing sharply on the present critical condition in the cement industry with respect to fatal accidents. Because of space limitations we can quote only some of the high spots in Mr. Dempster's admirable paper:

"Getting 'punch' into a safety campaign! What is this 'punch'? The word, as it is used here, is not found in the dictionaries and the only alternate word we can use for it is 'pep'. It is a sort of enthusiasm with a 'kick' in it, or sincerity carried to the highest degree. Can you imagine that any campaign is going to be successful if it is conducted in a half-hearted manner without any thrills whatever, much less a safety campaign, which is to a great extent a psychological reaction?

"Sometimes I wonder whether we are all safety workers, or whether we are putting up a certain amount of bluff, for we all know that accident-reduction in the cement industry is not satisfactory. I know that some of you are saying that our figures are showing a great reduction; but, I ask you, a reduction from what? Say we had one thousand accidents last year and seven hundred and fifty this year, has accident-prevention improved twenty-five per cent? How do you know that a large percentage of that reduction was not due to the fact that a different class of men was involved, or due to improved operating conditions to increase production? I want to say this, that as long as we can read in the records of the Portland Cement Association, month after month and year after year, without a break in the continuity, accounts of screw-conveyor accidents and fatalities from other causes, we have nothing to be proud of, but rather does it constitute a disgrace—a disgrace to the cement industry and a disgrace to the civilization of North America.

Getting the Punch

"PUNCH! We need a punch all right, AND HERE IT IS! If we need any more punch than the statement I am going to make, we had better quit calling ourselves safety workers. Do you know that, while we have been patting ourselves on our backs and receiving plaudits from everyone, because of the reduction in the total number of all accidents, that the number of fatal accidents has been steadily

Jack Dempster

and insiduously on the increase? Do you realize that fatalities in the cement industry have increased, until their total is 65% greater for eight months of 1929 than for the same period of 1928, and where's it going to stop? We are the ones who are responsible for the deaths of those men! We are the ones who will be responsible for every fatality that adds to this year's total, and we are the ones who should, if we have any manhood at all, have no rest as long as we allow these fatalities to remain as a dirty blot on the pages of our record."

"What a terrible thing a fatal accident is! Just suppose YOU were the next to be stricken down. Can you see what it would mean? And yet, because of the luke-warm, half-hearted attitude that some of us are taking in this work, it strikes me that none of us is immune. We are too complacent; we are not getting punch into our work at all. We are trying to shift the responsibility, evade the issue and then deplore the facts. If saving human lives won't afford a 'kick,' surely saving money will and we can dig up stacks of records proving that safety work saves money and speeds up production. The kick that we get out of it will be in proportion to the punch that we put in.

"This work is never going to be finished; we are going to receive set-backs and discouragements, but the spirit that has placed portland cement in the position it occupies in the world today is the spirit that will reduce the accidents from the portland cement industry to practically a vanishing point."

Fatal Accidents

The paper read on Wednesday morning's session of the cement section by W. H. Weitknecht, was an almost perfect sequel to Mr. Dempster's discourse, reported above. Mr. Weitknecht, who is superintendent of the Lehigh Portland Cement Co.'s plant at Mitchell, Ind., has been making a study of fatal accidents as chairman of a subcommittee of the committee on accident prevention of the Portland Cement Association, devoting itself to this subject. After an examination of a large number of fatal and other accident reports, Mr. Weitknecht's conclusions carry a startling indictment of supervision in the cement mill organizations. The reports studied exposed laxity in recording data, rarely indicated investigation of the accident sufficient to reveal the real cause and showed lax supervision of the workmen and enforcement of safety rules.

Mr. Weitknecht said in part:

Measuring the Effectiveness of No-Accident Campaigns

"I think it will be admitted without question that the Portland Cement Association's annual 'Trophy Award' for the best accident prevention record in the industry has produced a greater interest and has brought about a larger reduction in the number of lost time accidents than any other one thing. This interest, amounting to competition among the operating organizations, has likewise challenged the attention of most of the executives in the industry, and has, therefore, become the most important factor in establishing accident prevention work in the industry on its present sound basis, certainly a worth-while accomplishment.

"But we cannot measure the effectiveness of this accident prevention work by the reduction in the number of lost-time accidents, for prior to this intense competitive interest there was a great deal of time charged to *lost time* accidents when, in reality, an accident resulting in a very minor injury furnished the basis for a brief vacation to the employe so injured. These vacation periods previously charged to *lost time* accidents have, in most operating organizations, disappeared, and a lost time accident now is legitimately a *lost time* accident. There is even danger that in our enthusiasm to establish a record we may step a little across the line on the other side. The real measure of accident prevention work is the reduction in fatalities and in the serious personal injury accidents resulting in permanent disabilities or long periods of temporary disability. After all, it is not the

occasional *no accident* record that counts but the permanent improvement.

"The fatality and permanent disability record for 1928 shows an increase in both classes from the preceding year, notwithstanding the reduction in man hours worked from approximately 93,800,000 to 85,800,000 man hours. To make a study to ascertain, if possible, the reason for this increase and report at this time is the purpose of this paper.

"I shall, at the outset, state the conclusion as a sort of a proposition, and then endeavor to prove it from the records. I do not believe that the increase in the number of serious and fatal injuries which occurred in the cement industry during 1928 and those which have thus far occurred during 1929 indicate a general reaction or slump following a period of intensive accident prevention effort, but rather that the much smaller number of these accidents during the year 1927 and the but slightly increased number for the year 1928 was coincidental with and not the result of that effort. The much larger number of fatalities thus far reported for 1929 when, during the same period, the number of plants reporting *no lost time* accidents to date is larger than ever, tends to confirm the belief already expressed.

No-Fatality Year the Goal

"Nor do I believe that the years 1927 and 1928 record the best results that may reasonably be expected in the cement industry. I believe, and am bold enough to go on record here and now, to predict that the cement industry will some day celebrate a *no fatality year,* for the analysis of the 1928 fatal accident reports clearly indicates, if it doesn't actually prove, that that possibility should have been a near reality for last year, so far as preventable, reasonably preventable accidents, were concerned; if the supervisory management, that is, the operating management from general manager and superintendent to the department foreman and sub-foreman, had been as competent and as efficient in their supervision method and practice as they reasonably ought to have been.

"The criticism of accident reports which follows is intended to be constructive and to stimulate more thorough accident prevention, with correspondingly fuller and more correct reports of each accident. It is seldom that the real cause of the accident is given in the reports. In most cases it must be inferred from very incomplete descriptions of the accidents, and the inferences which follow are only suggestive, and cover but a few of the inquiries and suggestions that might be made from the nature of the different accidents as reported.

Criticism of Fatality Reports

"Following are the reported fatalities occurring during 1928 with assigned causes for the accidents and comments thereon: (Only five will be quoted for lack of space.)

"Report A—American, Age 21; length of service 2 weeks.

Occupation—Construction laborer.

Location—Under No. 1 kiln.

"Assigned cause of accident—Took hold of wire which was in contact with a live wire. COMMENT: What had occurred to bring this wire in contact with the live wire? Was the charged condition of the wire known and had reasonable safeguards been installed? Had the man been warned of this danger and did he forget? The report contains no information to infer the real cause of the accident. It would appear that the cause of the accident was either carelessness or what is more likely—improper supervision.

"Report B—Polish American, Age 53; length of service 6½ yrs.

Occupation—Raw mixer.

Location—Pulley driving raw elevators and conveyors.

"Assigned cause of the accident—Using iron bar to scrape belt dressing off pulley while in motion. Bar caught by belt, striking injured in abdomen.

"Nature of injury—Puncture of lower bowel, left-side — peritonitis. COMMENT: The long period of time employed and the accident suggests a serious charge against incompetent supervision as the cause of this accident. As a first offense of a new employe it might be chargeable to insufficient instruction or violation of instructions. The report shows the man at his regular occupation and it is reasonable to infer that this employe had been working in this department for a sufficient length of time to be warned against such dangerous practice. A reasonable inference would be that improper supervision was the cause of the accident.

"Report C—Italian, age 47. Report shows accident occurring on date of employment.

Occupation—coal miller.

Location—inside coal house elevator shaft.

"Assigned cause of accident—Struck by coal elevator while inspecting for repairs.

"Nature of Injury: Fractured skull and fracture of right arm. COMMENT: It would appear that there was an attempted inspection of the elevator while in operation, which suggests improper instructions or a violation of instructions. However, carelessness, depending on circumstances might also have been the cause of the accident."

"Report D—American, age, 29, in service 11 yrs.

Occupation—Switchboard operator.

Location—Back of switchboard in power house.

"Assigned cause of accident—While attempting to insulate exposed nut on 6600-v. pothead, worker's hand evidently came into contact with pothead terminal and either grounded or short-circuited same, the current passing through the body. COMMENT: Further details of this accident report that the electrician was installing new potheads back of the switchboard when the switchboard operator felt that the electrician was in danger of coming into contact with high voltage circuit and went back of switchboard to insulate an exposed point of danger.

"This accident suggests a wrong diagnosis by an expert consulting physcian. Incompetence cannot be assigned as the accident. Hardly carelessness. Misdirected judgment on the part of an experienced employe was the cause of this fatality.

"Report E—Croatian, age 40, length of service not given.

Regular Occupation—yard laborer.

Location—crusher.

"Assigned cause of accident—Was opening knuckle on rock car and car was bumped from rear. Car struck him and crushed side of face and chest. COMMENT: The accident and the nature of the injury are given as the cause of the accident, when it is evident that the cause of the accident must lie in the bumping of the car. Carelessness on the part of some one other than the injured party is the probable cause. If the clearance between the cars is insufficient defective equipment may be the principal cause."

Supervision Must Be Better

Mr. Weitknecht continued with his analysis and comment until he had covered the entire list of 33 fatal accidents suffered by the cement industry in 1928. The effect was to pile up a preponderance of evidence in proof of his announced theory that supervisory management was not as efficient as it reasonably should have been. He closed with the following:

"Investigation to ascertain the real causes of accidents is the first essential in preventing their recurrence. It is the diagnosis of accident prevention. It is commonly accepted that a physcian's most important service in any given case is the correct diagnosis of the ailment. The treatment may vary somewhat as the conditions and responsiveness of the patient may indicate, but correct diagnosis is the essential. Let me carry this analogy a step further. It is becoming more and more the custom that persons consult their physcian at the first suggestive indication of an ailment, to ward off a possible resulting illness. What about investigating those accidents, many of them of the major class, which do not result in injuries, but contain all the possibilities of them?"

Joint Luncheon

The joint luncheon of the cement and quarry sections on Tuesday noon proved a pleasant feature of the meeting which has been repeated for several years. **J. B. John,** president of the Medusa Portland Cement Co., and chairman of the committee on accident prevention of the Portland Cement Association, presided. The speakers were **Major H. A. Reninger,** retiring president of the National Safety Council and **J. I. Banash,** chairman of the general program committee of the National Safety Council.

Quarry Section Meeting

THE QUARRY SECTION MEETINGS of the National Safety Congress were not attended by a very large group, but those who were there took part in lively and interesting discussions. No small share of credit for the success of this meeting is due R. E. Colville, general chairman of the quarry section, who is manager of the insurance department of the United States Gypsum Co. The large and rather unusual experience of this company in accident prevention furnished the background for much interesting discussion.

Progress of Safety Reviewed

In his opening address Chairman Colville reviewed the program of the quarry section of the National Safety Council, which now has 68 members, and mentioned particularly the entrance of the sand and gravel industry into the sphere of organized safety work. Mr. Colville said special value should come from the cooperation of such associations as the National Crushed Stone Association and the National Sand and Gravel Association, pointing to the splendid results already achieved by the Portland Cement Association with the assistance of the National Safety Council.

The activities of the quarry section during the past year have included the issuance of six special posters, the establishment of a monthly news letter (edited by J. R. Boyd, secretary of the National Crushed Stone Association), a large fund of experience and statistics, and the compilation of a "Safety Manual for Quarries." The latter was unanimously adopted as a tentative guide for members, subject to such changes as best adapt it to meet local conditions. The "Manual" consists of 47 pp. of mimeographed sheets, and copies may be obtained from the secretary of the quarry section, J. R. Boyd.

Albert L. Worthen Elected Chairman

Albert L. Worthen, vice-president of the Connecticut Quarries Co., New Haven, Conn., was unanimously elected general chairman of the quarry section of the National Safety Council for the ensuing year. Mr. Worthen is a member of the executive committee of the National Crushed Stone Association and has been active in its affairs for several years. It is expected that his election as chairman of the quarry section of the National Safety Council will bring the two organizations into closer contact for effective accident prevention work in the quarry industry. The chairman of the quarry section is ex-officio a member of the executive committee of the National Safety Council.

Albert L. Worthen

Other officers elected by the quarry section are: H. F. Yotter, insurance supervisor, General Crushed Stone Co., Easton, Penn., vice-chairman; J. R. Boyd, secretary National Crushed Stone Association, Washington, D. C., secretary; V. P. Ahearn, executive secretary, National Sand & Gravel Association, Washington, D. C., in charge of publicity, and W. W. Adams, statistician, United States Bureau of Mines, Washington, D. C., statistician.

Safety Through the Eyes

H. F. Yotter, insurance supervisor, General Crushed Stone Co., Easton, Penn., read a brief paper on the use of posters and bulletin boards to drive home the safety lesson. He emphasized the importance of having the right kind of posters. Many of those developed and used by the cement section of the Council are equally applicable to commerical crushed stone operations. Mr. Yotter has found that home-made posters consisting of photographs of actual accidents in the company's own plants, with a brief exposition of how the accident occurred, are especially effective. He said slogan and statistical posters are good on occasion.

The best place to post the posters and bulletins is worthy of some consideration. The trouble with posters generally, Mr. Yotter said, is that many of them are not good. A few posters and frequent changes he had found the best policy. Numerous posters already printed are available to members of the National Safety Council, and Mr. Yotter and Chairman Colville both urged the cooperation of members of the quarry section in the preparation of additional posters especially for the use of members of this section.

The discussion of Mr. Yotter's paper dealt largely with the type of poster to use, and it was developed that the so-called "negative" type, picturing some horrible example, was often very effective in driving home the intended lesson.

F. H. Edwards, general superintendent of Connecticut Quarries Co., New Haven, Conn., raised the question of getting men

R. E. Colville

Placing the liquid oxygen explosive

Interested spectators at the quarry

to wear goggles, and what is a satisfactory kind of goggle. Unless the goggles are satisfactory they are as likely to increase the hazards of men working in quarries and crushing plants, as to diminish them. Nevertheless, eye accidents are too frequent in nearly all rock products operations. The goggles should be carefully tested to avoid glass with bubbles or streaks. Several recommended the Wilson goggles (Wilson Products, Inc., Reading, Penn.) as especially suitable for rock products operations.

Accident Statistics

W. W. Adams, statistician, United States Bureau of Mines, Washington, D. C., reviewed the statistics of quarry and crushing plant accidents for the years 1928 and 1927. He said it was a pleasure to discuss 1928 statistics because of the splendid progress made in reducing the accident rate in all the quarry industries except lime manufacture. Here the accident rate per 1,000 men employed increased from 166.08 in 1927 to 182.04 in 1928. The cement industry, of course, showed the best record.

Mr. Adams said he believed the other groups in the quarry industry could do equally as well as the cement-mill group. He praised the safety competitions in the cement, crushed stone and gravel industries as effective aids. These seven groups in the quarry industries had a better record in 1928 than in any previous year: Cement, limestone, trap rock, granite, marble, sandstone and slate.

There are now, according to Mr. Adams, 93 underground quarrying or mining operations, mostly in limestone, and these had the best accident record of any underground mining group.

The principal causes of accidents in quarries and crushing plants, Mr. Adams said, had not changed their relative importance in the 1928 statistics. Excellent continuous records of accidents now exist in the quarry industry and the Bureau of Mines is making a more intensive study of them than ever before.

The discussion of Mr. Adams' talk was largely as to whether some companies, when a prize award was to be made, were entirely honest in reporting accidents. The general belief was, that while there were undoubtedly instances of men being brought to work on stretchers, in order to avoid reporting lost time, these instances were very rare, and were diminishing.

Executive's Viewpoint

B. E. Welty, production manager, Pacific division, United States Gypsum Co., enlarged upon his company's attitude that lost-time accidents are a waste, the same as excessive costs or other evidence of inefficiency in management. Consequently accident prevention is urged upon superintendents and foremen the same as any other labor-saving. Mr. Welty said it had taken several years' work to get real honesty and truthfulness in accident reports. He thought there was a good deal of bunkum in safety campaigns as ordinarily conducted. It is a matter of business efficiency and should be so recognized; one should not urge employes "to please regard safety precautions," but tell them "you have got to regard safety precautions"—or be fired. He said by enforcement of such a policy his company had reduced accidents thus far in 1929, as compared with the same period in 1928, by 23%, and made a direct saving of $18,000.

Mr. Welty emphasized the necessity of

After the blast

Listening to an explanation of the liquid oxygen process

doing away with all needless rules and regulations, reducing instructions to a minimum. He further explained, and Chairman Colville elaborated, that notwithstanding this seemingly "hard-boiled" attitude his company had not lost the humanitarian point of view. The discussion developed along lines of the best way to handle men—foremen particularly—since they are generally the ones held directly responsible for negligence; and it was made clear that there must be sincerity on both sides—executives and foremen—if satisfactory results are to be obtained.

News Letter

J. R. Boyd, secretary, National Crushed Stone Association, Washington, D. C., reviewed his experience as editor of the quarry section's monthly news letter to members, and pleaded for more help from the readers.

Fundamentals

R. B. Wortley, superintendent, Wakefield Iron Co., Wakefield, Mich., under the title "Fundamentals in Accident Prevention as Practiced by the Wakefield Iron Co., read a brief paper that stuck close to the subject. This company's operation is a quarry, or open-pit mine. It is one of the M. A. Hanna Co.'s enterprises and consequently has the benefit of one of the largest industrial safety organizations behind it. Mr. Wortley described briefly the place and purpose of a "safety manual," bulletin boards, local meetings, motion pictures, etc., in safety educational work. For enforcing safety his company uses a policy of both rewards and discipline.

Otho M. Graves Addresses Executives

The eloquent address made to the quarry section of the National Safety Council, at the National Safety Congress in Chicago in 1927, by Otho M. Graves, vice-president and general manager of the General Crushed Stone Co., Easton, Penn., had attracted such wide attention that this year he was asked to repeat it to an audience of industrial and business executives from all branches of business and industry. Accordingly the revised address, under the title of "The Executive and Safety," was delivered to a "full house" of about 1,500 of the foremost executives in this country. The original address, which was more particularly directed to executives in the quarry industry, was published in full in Rock Products, October 1, 1927.

Excursion to Dolese and Shepard Quarry

An attractive feature of the congress, attended by about 70 delegates to the cement, quarry and mining sections, was an excursion to the quarry and crushing plant of the Dolese and Shepard Co., about 20 miles west of Chicago. Here the visitors saw an interesting installation of the Woodford, centrally-controlled, electric haulage system and a blast, using "Loxite" explosive—liquid oxygen. Following the quarry inspection a visit was made to the Loxite Co.'s plant where the liquid oxygen is made, and carbon cartridges soaked for quarry use.

Feldspar Mining in North Carolina

THE EDITOR: The article on "Feldspar Mining in North Carolina," by H. J. Bryson, state geologist, on pp. 53-56, Rock Products, September 14, contains errors which should be corrected. The name of this company is repeated several times as Tennessee Mines Products Co. instead of Tennessee Mineral Products Corp.

Under the paragraph on "Mine Practice," he states that our Deer Park mine does not operate the full capacity due to the high cost of mining. The facts are that this mine is one of the largest producers in the industry. Production costs at this mine compare favorably with open-cut operations, and it has the additional advantage of being entirely underground so that the work is unaffected by weather conditions. In the same paragraph Mr. Bryson gives average cost of mining feldspar as about $3 per ton. This is about half of the actual cost. We are now paying $5 per ton for the lowest grade and as high as $7.50 for better grades; and there are indications that these prices will have to be increased to obtain the tonnage desired.

There are several other misstatements in the article, but they are of minor significance compared to those above.

Last year 31 feldspar grinding plants reported production. Twelve of these plants could have supplied the entire tonnage consumed. As a result there has been such competition for the business that the price of ground spar is down to where the industry is making less than 5% on its investment. Articles like Mr. Bryson's, giving misleading information, have been responsible for present over development.

Tennessee Mineral Products Corp.,
B. C. Burgess,
Manager.

Spruce Pine, N. C.

Scott Turner Sails to Attend World Engineering Congress

SCOTT TURNER, director of the United States Bureau of Mines, sailed from San Francisco on October 10 to attend the World Enginering Congress at Tokio. He was appointed by President Hoover as one of the five federal engineers who are to represent the United States government at this congress. Mr. Turner is also listed as a member of the official party representing the American Institute of Mining and Metallurgical Engineers. He plans to return to the United States the latter part of November.

Coplay Cement Sponsors Safety Rally

THE Coplay Cement Manufacturing Co. recently sponsored one of the largest safety meetings ever held in the Lehigh Valley territory. This meeting was arranged by the company's safety committee and was held in the spacious new Coplay high school auditorium

The evening's program consisted of motion pictures on industrial safety and comics. Music was furnished by Meixler's orchestra of Coplay. The Coplay Saengerbund, under the direction of their leader, Otto Kurtz, furnished several fine selections.

The guest speakers of the evening were K. A. Colahan, district engineer of the American Mutual Liability Insurance Co., Philadelphia, who spoke on "Reasonable Reasons for Safety," and Thomas J. Quigley, chief of the quarry section of the Bureau of Inspection, Harrisburg, who addressed the audience on "Safety in Cement Mills and Quarries." He also spoke of the state's campaign for safety.

The meeting was presided over by chairman of the safety committee, Wayne F. Nagle.—*Bethlehem* (Penn.) *Times.*

Illinois Paving Brick Interests Start Campaign

CAMPAIGN of Illinois brick manufacturers to commit the Illinois state highway commission to a policy of at least 20% of brick-surfaced roads on secondary highway routes constructed under state gas tax revenues has enlisted support of the local Chamber of Commerce. A special committee of three was named recently by the local organization to present a plea to the commission for greater use of brick in paving projects under its authority.

Summary of Trade Practice Conferences Available

TRADE ASSOCIATIONS and business organizations generally are doing a splendid work in eliminating trade abuses, the Federal Trade Commission stated September 26 in announcing the issuance of a pamphlet on the trade practice conferences dealt with by the commission.

More than 300 rules have been adopted so far, and the number of industries which have held trade practice conferences is nearly 70.

Rules of business practice adopted by industries at 56 of these conferences have been acted on by the commission. The complete sets of rules together with condensed journals of each conference are presented in the booklet, "Trade Practice Conferences."

Copies of the pamphlet will be furnished for 25 cents each by the Superintendent of Documents, Government Printing Office, Washington, D. C.

Foreign Abstracts and Patent Review

Reducing the Water Content in Portland Cement Slurry by Chemical Means. Budnikoff, Kukolew and Leschoew of Charkow, Russia, attempted to reduce the water content of slurry, which varies between 36 and 50% of the weight of the slurry, in order to effect a saving in fuel. They prepared slurries of desirable mixes of clay with limestone and shale, marl with chalk, high and low marls and also pure marls. However, the advantages of the wet process manufacture were to be retained, especially the ability of flow of the slurry.

The first material for experimenting was a mix of marl and chalk from a cement plant analyzing 76% of $CaCO_3$. The water content of the "nominal" slurry was assumed to be 48%.

According to the assumption that 1 kg. (2.2 lb.) of clinker is obtained from a dry mixture of 1.5 kg., $\frac{48}{52} \times 1.5 = 1.39$ kg. of water would have to be evaporated per 1 kg. of clinker. With a waste gas temperature of the cement kiln of 400 deg. C. (752 deg. F.) the heat content of this steam volume would be $1.39 \times (606.5 \times 0.305 \times 400) = 1012$ W.E. (1 W.E. is 4 B.t.u.), according to Regnault.

The fuel consumption in the wet process is 30 to 35%. At a fuel consumption of 35%, $0.35 \times 7000 = 2450$ W.E. is liberated per 1 kg. of clinker; this means that $\frac{1012 \times 100}{2450} = 41.3\%$ of the entire heat is lost in the water vapors. This great loss is the best reference to the importance of decreasing the water content of the slurry.

For this purpose an addition of bases or basic salts to the slurry has proven suitable; these split off hydroxyl-ions due to the hydrolysis. The viscosity of the above mentioned slurry containing 48% water was determined by means of the Kohl viscosimeter and it was found that the 100 cu. cm. discharge is discharged in 10 sec. Following this, slurries were prepared with 45.0, 42.5, and 40.0% water or with the same quantities of hydrous Na_2CO_3-, Na_2SiO_3- and NaOH-solutions of various concentrations. In every case the viscosity was determined by means of the Kohl viscosimeter after agitation.

The test results are given in Table I and graphically in Figs. 1, 2 and 3. The latter show the viscosities dependent on the concentration of the three salt solutions. The horizontal dotted lines refer to the discharge velocity of the "normal" slurry (48% water content with no addition of electrolyte), which is 10 seconds.

The test results indicate that the introduction of the above mentioned admixtures effects a considerable dilution of the slurry. This dilution depends on the concentration of the electrolyte; after the dilution has reached its maximum, its viscosity increases again. The dilution decreases with reduction of the water content of the slurry.

A slurry prepared with 45% of $N/0.05$ and $N/0.01$ solution of Na_2CO_3, Na_2SiO_3 and NaOH has a greater ability to flow than a "normal" slurry. At 42.5% of $N/0.05$ solution of Na_2CO_3 and $N/0.05$ and $N/0.01$ solution of Na_2SiO_3, the slurry viscosities come very close to the viscosities with 48% water. At 40% the diluting effect is very strong, but no slurry reaches the ability to flow of the "normal" slurry.

The NaOH solution in the concentrations of $N/0.15$ and $N/0.10$ produces in all cases a mass which does not flow at all; at 42.5 and 40% it dilutes less than Na_2CO_3 and Na_2SiO_3. Soda has a very strong diluting effect, and yet a weaker one than the Na_2SiO_3 solution, which has a maximum effect. The $N/0.1$ solution of Na_2SiO_3 results in a discharge period for the slurry of 10.4 sec., which almost coincides with the discharge velocity of 10 sec. for the "normal" slurry.

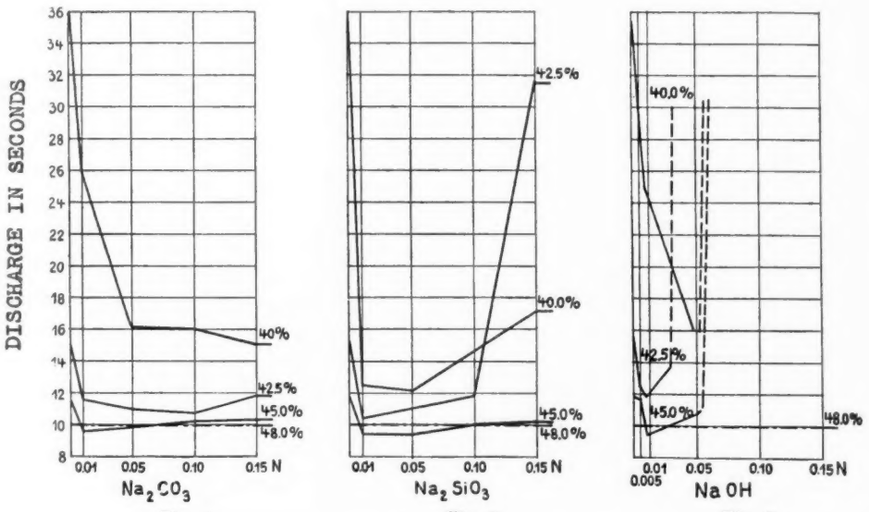


Fig. 1 *Fig. 2* *Fig. 3*

Viscosities of cement slurries treated with bases and basic salts

From the above statements it is apparent that a decrease in water content from 48% to 42.5% comes under consideration in practice. The use of a $N/0.01$ Na_2SiO_3 solution has proven to be the most advantageous. The quantity of Na_2SiO_3 is thereby only 0.07%, based upon the weight of the clinker.

The water content per kg. clinker decreases from 1.39 kg. to $\frac{42.5}{57.5} \times 1.5 = 1.11$ kg., or about 20%. The difference in the heat used is $(1.39 - 1.11) \times [606.5 + (0.305 \times 400)] = 204$ W.E. The fuel saving is therefore $\frac{204}{2450} \times 100 = 8.3\%$. Furthermore, the output of the rotary kiln is increased and the energy required in grinding decreased. By using mixtures which require smaller volumes of water the diluting effect is still greater, since it was determined that the diluting effect increases with a decrease in water volume.—*Zement* (1929), **18**, 24.

DISCHARGE TIME OF 100 CC. OF SLURRY, IN SECONDS

Moisture content	48%	45%						42.5%						40%					
Concentration $N/1$	0	0	0.15	0.10	0.05	0.01	0.005	0	0.15	0.10	0.05	0.01	0.005	0	0.15	0.10	0.05	0.01	0.005
Electrolyte																			
	10																		
Na_2CO_3	....	11.8	10.4	10.2	9.8	9.6	....	15.4	11.8	10.8	11.0	11.6	....	36.0	15.2	16.0	16.1	25.8	....
Na_2SiO_3	....	11.8	10.2	10.0	9.4	9.4	....	15.4	31.6	11.9	11.0	10.4	....	36.0	17.2	14.6	12.2	12.4	....
NaOH	....	11.8	Does not flow		10.8	9.4	11.8	15.4	Does not flow		13.6	11.8	12.8	36.0	Does not flow		15.8	25.0	....

Setting of Cement. Dr. H. Gessner contributed three articles to the *Kolloid-Zeitschrift* (1928) **46**, 3; (1929) **47**, 1, 2, which have been reprinted in book form. (Th. Steinkopff, Dresden and Leipzig, price

RM. 4.00.) The author treats the problem of setting from a purely colloid-chemical viewpoint. He discusses the granular size and the colloidal structure of cement, investigates the viscosity of newly made cement pastes and gives measurement data on the conductivity of the latter. Details of experiments on expansion of concrete and measurements of the hydration process are given. Numerous tables and drawings are of assistance in furthering cement research. —*Zement* (1929), **18,** 24.

Laboratory Manufacture of Cement and Test Methods. H. Kuehl describes the apparatus and method for production of cements on a small scale particularly adaptable for development of test methods.—*Tonindustrie-Zeitung* (1929) **53,** 19.

Grecian Cement Industry. The first cement plant was the "Titan" at Eleusis, erected in 1902. Now there are also the "Heraklis" in the Piraeus, the "Olympos" in Volo and a fourth plant is nearly completed near Chalkis. The three existing plants have a total annual capacity of 150,000 tons. More plants are to be built to eliminate imports, which were 80,000 tons of cement in 1928.—*Tonindustrie-Zeitung* (1929), **53,** 39.

The Finnish Lime Industry. According to Moritz, the Finnish limestone, which is available mostly in the form of crystalline calcite, is burned mostly in ring kilns, crumbling completely during the burn, so that normal kiln firing is impossible. Mechanical means are provided to make adjustments for the volume shrinking of the material and to reduce the strong air current passing over the lime. The air for burning is supplied through special ducts placed at each door and crosswise through the burning flue, being exposed about two chambers back to the fire. The lime industry is controlled principally by the Pargas-Kalkbergs-Aktiebolag, Pargas; the Lojo-Kalkverk-Aktiebolag, Helsingfors, and the Karl Forsstroem concern, Foerby. The Pargas concern uses Cheddite in its blasting; this is an explosive made from potassium chlorate by the electrolytic process in a hydro-electric plant. It employs Ingersoll-Rand equipment in drilling. The Pargas company's homes, schools, hospitals, moving picture houses, etc., for its employes at Pargas are a feature; its engineers are provided with the best foreign technical literature and an elaborate technical library.—*Tonindustrie-Zeitung* (1929), **53,** 18.

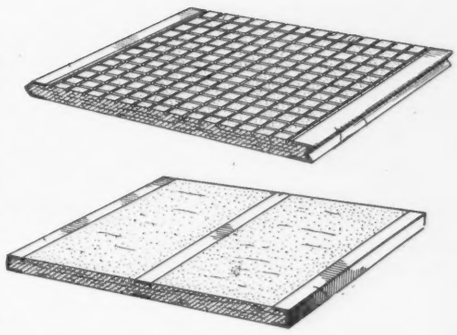
Constitution of Slag Cement. Langavant, referring to the researches on aluminates made by Le Chatelier, Candlot and Lafuma, discusses the fundamental differences in chemical action in the setting and hardening of portland cement and slag cement. The Lafuma method of studying the portland cement reactions is suitable for the study of slags and the slag cements.—*Le Ciment* (1929) **34,** 4.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Automatic Mixing or Blending Bin. According to the present invention, a specially constructed bin is utilized, provided with means for bedding the material within the bin from the top, and for withdrawing the material from the bottom of the bin, the operations being wholly or part automatic and continuous, so that one bin and one set of apparatus for filling and discharging the bin will serve for practically continuous draw-off during one, two or three shift operations, whereas the feed may be intermittent or during one shift only. Preferably a long, rectangular bin is utilized, of sufficient height to permit storage of the requisite quantity of material. Apparatus, such as automatic trippers, positioned above the bin, automatically lays down the material in successive, substantially parallel layers. A plurality of feeders, of any desired form, are spaced at frequent intervals along the bottom of the bin, so as to simultaneously draw off material from substantially all portions of the bottom of the bedded mass of material within the bin. The parts are so arranged that the approximate plane along which the feeders draw off material is inclined to the parallel planes of the beds or layers, so that the several feeders will simultaneously draw material from different layers within the bin. The feeders all deliver the material to a traveling belt conveyor which serves to collect and assemble the different lots of material withdrawn by the several feeders and deliver all of this mixed material to some desired location.—*Andrews Allen, assignor to Allan and Garcia, Chicago.* U. S. Patent No. 1,720,112.

Plaster Board Without Cover Sheets. The cementitious core or plastic composition

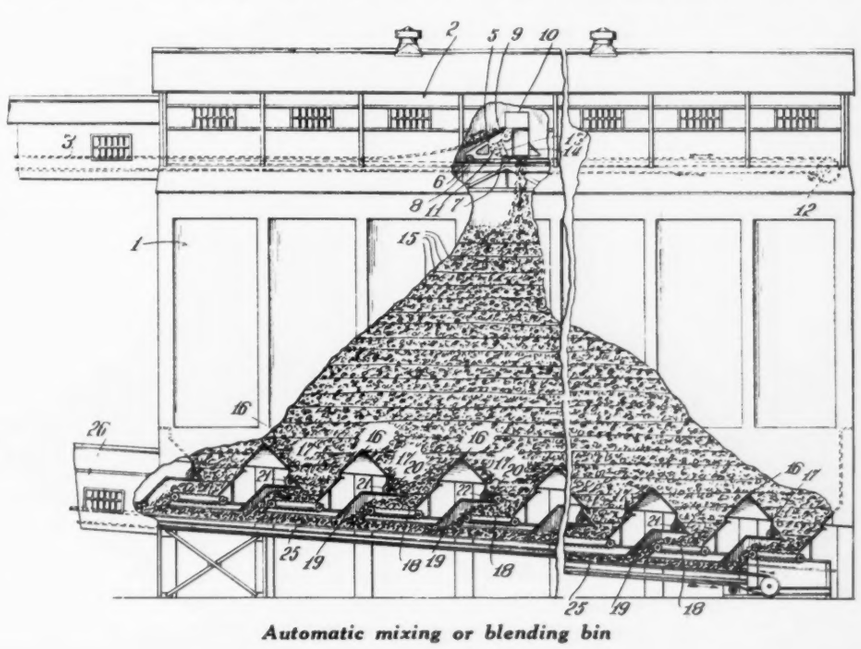


Plaster board without cover sheets

is reinforced by the addition of hair, flax, fibre-like material or others so that cover sheets may be dispensed with. Edges of the board are reinforced by protecting strips of paper, the strips and slab being bonded throughout their entire contiguous faces.—*John Schumacher,* U. S. Patent No. 1,719,200.

Concrete Lumber. Building material which in set condition is nail-penetrable and capable of being sawed, comprising Florida shell rock containing substantially 95% $CaCO_3$ and in crushed condition such that approximately 90% thereof will pass through a screen of between ½- to 2-in. mesh, and a binder including lime and hydraulic cement, each comprising 5 to 15% of the entire mixture.—*B. F. Williamson (assignor to Stone Homes Process, Ind., Gainesville, Fla.),* U. S. Patent No. 1,716,749.

Reinforced-Edge Wallboard. The side edges are reinforced to withstand rough usage in shipping and handling, and also to enable them to make a smooth flush and butt joint on walls.—*Caleb Payne (assignor to Gypsum Engineering and Manufacturing Co., Chicago),* U. S. Patent No. 1,720,856.



Automatic mixing or blending bin

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGC OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended Sept. 7	Limestone Flux Week ended Sept. 14	Sand, Stone and Gravel Week ended Sept. 7	Sand, Stone and Gravel Week ended Sept. 14
Eastern	3,702	4,199	17,052	18,735
Allegheny	3,927	4,557	10,241	11,315
Pocahontas	441	351	1,446	1,503
Southern	598	719	9,851	9,271
Northwestern	1,714	1,635	9,310	9,726
Central Western	458	543	12,890	13,459
Southwestern	587	619	9,310	9,191
Total	11,427	12,623	70,100	73,200

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1928 AND 1929

District	Limestone Flux 1928 Period to date Sept. 15	Limestone Flux 1929 Period to date Sept. 14	Sand, Stone and Gravel 1928 Period to date Sept. 15	Sand, Stone and Gravel 1929 Period to date Sept. 14
Eastern	107,330	123,249	382,487	394,510
Allegheny	123,318	131,513	262,150	254,617
Pocahontas	17,079	13,970	29,556	34,861
Southern	21,161	19,756	387,274	325,693
Northwestern	49,431	40,889	237,067	224,277
Central Western	15,960	18,959	375,035	380,218
Southwestern	15,023	17,724	224,823	241,741
Total	349,302	366,060	1,898,392	1,855,917

COMPARATIVE TOTAL LOADINGS, 1928 AND 1929

	1928	1929
Limestone flux	*349,302*	*366,060*
Sand, stone, gravel	*1,898,392*	*1,855,917*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning October 5:

SOUTHERN FREIGHT ASSOCIATION DOCKET

47237. **Crushed stone,** from Vick, N. C., to Norfolk Southern R. R. stations. It is proposed to revise the rates on crushed stone, carloads, from Vick, N. C., to specifically named stations on the Norfolk Southern R. R. A statement of the present and proposed rates will be furnished upon request.

47306. **Sand, gravel, slag, stone and chert** from Hopewell, Va., to S. A. L. Ry. stations in North and South Carolina. It is proposed to revise the rates on stone, sand, gravel, slag and chert, carloads, from Hopewell, Va., to stations on the Seaboard Air Line Ry. in North and South Carolina to be no higher than the scale prescribed by the Interstate Commerce Commission in Docket 17517 applied to the continuous distance, which will be made available at the beginning of operation of the Hopewell Extension by the S. A. L. Ry.

47347. **Limestone,** from Ladds and Portland, Ga., to Cleveland, Tenn. Combination now applies. Proposed rate on limestone, ground or pulverized, carloads (See Note 1), except when cars are loaded to their visible capacity actual weight will govern, from Ladds and Portland, Ga., to Cleveland, Tenn., 158c per net ton.

47402. **Sand and gravel,** from Ellerslie and Warmore, Va., to Charlie Hope and Brodnax, Va. It is proposed to establish reduced rate of 110c per net ton on sand and gravel, carloads (See Note 3), from and to the above named points.

SOUTHWESTERN FREIGHT BUREAU DOCKET

18498. **Silica sand,** from Sico, Okla., to Louisiana and Texas points. To establish a rate of 11c per 100 lb. to LaRosen, Shreveport, La., 6½c per 100 lb. to Adams, Denison and Sherman, Tex., and 7c per 100 lb. to Paris, Tex., on silica sand, carloads. Minimum weight: (A) To stations LaRosen and Shreveport, La.; (B) Paris, Tex. (See Note 1), except when car is loaded to full visible capacity, actual weight but not less than 50,000 lb. will apply. (C) To stations Adams, Denison and Sherman, Tex. (See Note 1), but not less than 50,000 lb. It is desired to establish same rates on silica sand, from Sico, Okla., as currently applicable from Randolph and Roff, Okla.

18537. **Chatt, sand,** etc., between points in Missouri and Kansas, also between points in the Southwest. To establish the same distance scale of rates on chatt (mine gravel), whole or crushed; **crushed stone, including ground limestone,** in bulk or in bags, but not including gypsum rock; **gravel,** rip rap (irregular shaped rock in pieces ranging up to 200 lb. in weight); **sand** (except asbestos sand and silica sand, in straight or mixed carloads (See Note 3), between points in Missouri "B" territory and Kansas (state and interstate). Between points in Kansas and Missouri "B" territory, on the one hand, and points in Arkansas, Oklahoma, Louisiana and Texas (also Mississippi Valley as covered in I. C. C. Docket 17000, part 11, on the other, as authorized in I. C. C. Docket 17000, part 11. It is felt that the I. C. C. Docket 17000 scale having been prescribed for state and interstate application at points in southwestern states, it should be extended to include points in Missouri and Kansas as outlined.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

TEXAS-LOUISIANA TARIFF BUREAU DOCKET

2715-La. **Agricultural limestone,** stopping in transit between stations on K. C. S. Ry. in Louisiana for the purpose of partly unloading: Proposition from carriers to establish rules permitting the stopping in transit of agricultural limestone to be unloaded at stations on K. C. S. Ry. in Louisiana. Shipments to be waybilled in regular manner from points of origin to next station beyond the unloading point at tariff rate, plus $6.30 per car for the privilege of unloading at locations between stations, all charges to be prepaid. Not less than 10 carloads for any one train must be offered at one time.

WESTERN TRUNK LINE DOCKET

1564-T. **Stone, crushed, carloads** (See Note 2), except that when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will apply, but in no case shall the minimum weight be less than 50,000 lb., from Dell Rapids, S. D., to Creston, Ia. Present—Combination of locals; proposed, 12c.

ILLINOIS FREIGHT ASSOCIATION DOCKET

5092-A. **Silica, crude or ground,** carloads, minimum weight 60,000 lb., from Olive Branch, Ill., to Murphysboro, Ill. Rates in cents per ton 2,000 lb. Present, 95c; proposed, 88c.

5235. **Sand,** carloads (See Note 1), to Litchfield, Ill. Rates in cents per net ton.

From—	Present	Proposed
Lincoln, Ill.	88	76
Peoria-Pekin, Ill. (See Note)	101	89

Note—From Peoria maximum amount of switching charges absorbed 13c per ton of 2000 lb., or $6.30 per car.

5250. **Molding sand** (See Note 3), from Dallas City, Ill., to Meadville, Penn. Rates per ton. Present, $6.90; proposed, $3.91.

5253. **Molding sand,** carloads (See Note 3), but not less than 40,000 lb., from Iola, Ill. Rates in cents per net ton.

To—	Present	Proposed
St. Louis, Mo.	230	132
East St. Louis, Ill.	230	132
Belleville, Ill.	210	156
Springfied, Ill.	230	120
Decatur, Ill.	220	144
Quincy, Ill.	300	204

5261. **Silica sand,** carloads, from East St. Louis, Ill., to O'Fallon, Ill. Rates in cents per net ton. Present rate, 140c; proposed, *88c. *Rate applicable only from B. & O. tracks at East St. Louis, Ill. No switching will be absorbed out of this rate.

CENTRAL FREIGHT ASSOCIATION DOCKET

22842. To establish on **sand and gravel,** carloads, from Allison Branch, Ill., to Switz City, Ind., rate of 97c per net ton. Present rate, 13c.

22844. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica) **and gravel,** carloads, from Winona Lake, Ind., to Notre Dame, Ind., rate of 90c per net ton. Present rate, classification basis.

22845. To establish on **crushed stone and crushed stone screenings,** in bulk, in open cars, carloads, from Kenneth, Ind., to Medaryville, Ind., C. I. & L. Ry. delivery, rate of 85c per net ton. Present rate, 101c per net ton.

22846. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel,** carloads, from Richmond, Ind., to Spiceland, Ind., rate of 85c per net ton. Present rate, 97c per net ton.

*22863 (2), *cancels W. D. A. No. 21980—To establish on **sand, viz.: blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica,** carloads, from N. Y. C. & St. L. stations, Westfield, N. Y., to Lakeview, N. Y., shown below, to Rochester, N. Y., and points taking same rates:

Present rate to Rochester, N. Y., and points taking same rates, from the following New York points:

Westfield	*230	Silver Creek	†214
Portland	*230	Irving	†214
Brocton	*230	Farnham	*230
Concord	*230	Angola	*230
Van Buren	*230	Lakeview	*230
Dunkirk	*230	Falconer	‡150

Proposed rate to Rochester, N. Y., and points taking same rates (except to Batavia, N. Y., and Attica, N. Y.):

From	§Mi.	Rate	From	Mi.	Rate
Westfield	142	150	Silver Creek	116	150
Portland	135	150	Irving	112	150
Brocton	134	150	Farnham	111	150
Concord	131	150	Angola	106	150
Van Buren	130	150	Lakeview	99	150
Dunkirk	126	150	Falconer	150	

Proposed rate to Batavia, N. Y., and points directly intermediate on the Erie R. R., N. Y. C. R. R. and L. V. R. R.:

From	Mi.	Rate	From	Mi.	Rate
Westfield	94	130	Silver Creek	68	130
Portland	87	130	Irving	64	130
Brocton	86	130	Farnham	63	130
Concord	83	130	Angola	58	130
Van Buren	82	130	Lakeview	51	130
Dunkirk	78	130	Falconer	108	130

Proposed rate to Attica, N. Y., and points directly intermediate on the Erie R. R., N. Y. C. R. R. and L. V. R. R.:

From	Mi.	Rate	From	Mi.	Rate
Westfield	90	120	Silver Creek	64	120
Portland	83	120	Irving	60	120
Brocton	82	120	Farnham	59	120
Concord	79	120	Angola	54	120
Van Buren	78	120	Lakeview	47	120
Dunkirk	74	120	Falconer	98	120

*Present rate, Item 275B.
†Present rate, Item 632.
‡Present rate to Rochester, N. Y. (proper).
§Mileages shown are to Rochester (proper).

22908. To establish on **sand and gravel,** carloads, Cleves, O., to Fleming, Ind., rate of 95c per net ton. Present rate, 117c per net ton to Seymour, Ind., applicable to Fleming, Ind., account intermediate.

22902. To establish on **crushed stone,** carloads, from White Sulphur, O., to destinations shown below, following rates per net ton:

Eaton, W. Va.	$1.60
Pennsboro, W. Va.	1.70
Bristol, W. Va.	1.80
Simpson, W. Va.	1.90
Grafton, W. Va.	2.00

Present rates, sixth class.

22907. To establish on **rip rap or waste stone,** carloads, minimum weight per Item 8659 of C. F. A. L. Tariff 218F, from Georgia, Ind., to New York, N. Y., and points taking same rates, rate of 41c. Present rate, 49c.

22911. To establish on **sand and gravel,** carloads, from Fort Jefferson, O., to Rivare, Ind., rate of 90c per net ton. Present rate, sixth class.

22914. To establish on **"quarry waste or tailings,"** carloads (See Note 3), from Lewisburg, O., to Cement City, Mich., rate of 85c per net ton. Present rate, 90c per net ton.

22927. To establish on **crushed stone and crushed stone screenings,** carloads, from East Liberty, O., to stations shown below, following rates:

Albany, O.	90	Glouster, O.	90
Athens, O.	90	Drakes, O.	110
Gallipolis, O.	110		

Present rates, classification basis of sixth class.

22928. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel,** carloads, from Indianapolis and Columbus, Ind., to Fleming and Hayden, Ind., via P. R. R., Seymour, Ind., B. & O. R. R., following rates (present and proposed rates in cents per net ton):

From	Pres.	Prop.
Indianapolis, Ind., to Fleming, Ind.	**	95
Indianapolis, Ind., to Hayden, Ind.	**	95
Columbus, Ind., to Fleming, Ind.	92	95
Columbus, Ind., to Hayden, Ind.	92	85

**Classification basis.

22932. To establish on **sand and gravel,** carloads, from Wapakoneta, O., to Findlay, O., rate of 80c per net ton. Route via B. & O. R. R., Lima, O., and N. Y. C. & St. L. R. R. Present rate, 90c per net ton.

22934. To add Melvin, O., as a point of origin in Item 1190 of Agent Jones' Tariff 130R, covering rates on **agricultural limestone,** carloads, from Marble Cliff, Marblehead, Piqua, O., etc., to points in Ohio.

22941. To establish on **crushed stone** and **crushed stone screenings,** carloads, from East Liberty, O., to points in Ohio, rates as shown below. Present and proposed rates in cents per net ton, from East Liberty, O. (Route, N. Y. C.-B. & O.):

To	Prop.	Pres.
Columbus Grove, O.	95	**
Deshler, O.	100	**
Leipsic, O.	100	**
Ottawa, O.	95	**

**Class.

TRUNK LINE ASSOCIATION DOCKET

21785. **Crushed stone,** carloads (See Note 2), from Security, Md., to Kemps, Md., 45c per net ton. Present rate, 70c per net ton. Rate to expire December 31, 1929. Reason—To meet motor truck competition.

21789. **Stone, natural** (See Note 2), from South Bethlehem and Feura Bush, N. Y., to Petersburgh, N. Y., $1.40 per net ton. Present rate $1.55 per net ton. Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions.

M-1250. **Sand and gravel,** carloads (See Note 2), from Farmingdale and South Lakewood, N. J., to Collings Siding and Atsion, N. J., 65c per net ton, rates to expire December 31, 1930. Reason—To meet motor truck competition.

M-1254. To reduce rate of 65c to 55c per net ton on **crushed stone,** carloads, from Blakeslee, N. Y., to Canastota, N. Y., reduced rate to expire March 31, 1930. Reason—To meet motor truck competition.

M-1257. **Sand** (other than blast, engine, foundry, glass, molding, quartz, silex and silica) **and gravel,** except molding gravel (See Note 2), from Toms River, Pinewald and Quail Run, N. J., to Birdsboro, Penn., $1.60 per net ton; present rate, $1.70 per net ton. Reason—Proposed rates are comparable with rates on like commodities from and to points in the same general territory.

M-1260. **Sand and gravel,** carloads (See Note 2), from Farmingdale and South Lakewood, N. J., to Raritan River Railroad stations 75c per net ton, rate to expire December 31, 1930. Reason—To meet motor truck and water competition.

21819. To cancel from P. R. R. I. C. C. 123 commodity rates on **sand, blast, engine, fire, foundry, glass, molding, quartz, silex or silica,** carloads, and **sand** other than blast, engine, etc., carloads, from Philadelphia stations, except from Tacony, Bridesburg, Ontario Street and Shackamaxon, to various destinations in Philadelphia on the P. R. R. as shown in this tariff, classification basis to apply. Reason—Investigation develops that no traffic has moved under the above rates for some time and no prospects of future movements, therefore rates are obsolete.

21854. **Crushed stone and stone screenings,** carloads (See Note 2), from Hyndman, Penn., to stations on the Cumberland Division of the B. & O. R. R., south and west of Cumberland, Md., to and including Grafton, W. Va., rates ranging from 60c to $1.20 per net ton. Reason—Proposed rates are comparable with rates from Cumberland, Md., to same points of destination.

21858. **Crushed stone,** carloads (See Note 2), from Philadelphia, Penn., to Langhorne, Penn., 80c per net ton. Present rate, 85c per net ton. Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions.

21859. **Crushed stone,** carloads (See Note 2), from Birdsboro, Penn., to Locust Summit, Penn., $1.15 per net ton. Present rate, $1.60 per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

21860. **Refuse limestone screenings,** carloads (See Note 1), from Worthington, Penn., to Universal, Penn., 70c per net ton. Present rate, 80c per net ton. Reason—Proposed rate is comparable with rates from Annandale, Branchton, Harrisville and Wick, Penn.

21891. **Crushed stone,** carloads (See Note 2), from Dalmatic, Penn., to Millersburg, Penn., 65c per net ton, rate to expire June 30, 1930; present rate, 70c per net ton. Reason—To meet motor truck competition.

21901. To revise rates on **sand,** carloads, from Berkeley Springs, Great Cacapon, Hancock, W.Va., Hancock, Round Top and Cumberland, Md., and Triplett, Va., to Kanesholm, Mt. Jewett, St. Petersburg, Kane, Penn., Falls Creek, Punxsutawney, Dubois, Penn., and various. Statement of proposed rates will be furnished upon request.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

17894. To cancel commodity rate of $1.90 per net ton on **sand, refuse foundry,** from East Cambridge, Mass., to East Walpole, Mass., as named in Item 300 of B. & A. R. R. I. C. C. 9056, and apply in lieu thereof sixth class rate of 13½c per 100 lb. Reason—To cancel obsolete rate.

17910. **Stone, crushed,** and other commodities **taking same rates** (See Note 2), from Branford (Pine Orchard Quarry), East Haven, East Wallingford (Reeds Gap Quarry), Meriden (York Hill Quarry), Rocky Hill and Westfield (Hampden Quarry), Conn., to Providence, R. I. Present—From Westfield (Hampden Quarry), Conn., $1.10 net ton and from other points $1 net ton. Proposed—Extend the expiration date on the present rates until December 31, 1930. Reason—To continue to permit movement.

17934. **Sand, molding,** carloads (See Note 3), from Brookview, Niverville and Van Hoesen, N. Y., to Arcade, N. Y., via B. & A. R. R.-Albany, N. Y.-D. & H. Co., Binghamton, N. Y., Erie R. R.-Attica, N. Y., Arcade & Attica R. R. Present, 28½c; proposed, 11c. Reason—To equalize rate from competitive producing points in the same district.

17938. **Crushed stone** and other commodities taking same rates (page 389, N. Y. N. H. & H., I. C. C. FO-2795). In cents per net ton:

From Westfield, Mass., Hampden Quarry.

To—	Present	Proposed
Southbridge, Mass.	135	130
Sandersdale, Mass.	135	130
West Dudley, Mass.	135	130
Quinebaug, Conn.	130	130
Webster, Mass.	130	130

From Branford, Conn., Pine Orchard Quarry.

To—	Present	Proposed
Southbridge, Mass.	120	120
Sandersdale, Mass.	120	120
West Dudley, Mass.	120	120
Quinebaug, Conn.	120	120
Webster, Mass.	120	120

Reason—To extend rates until November 30, 1930.

610-3. Amended to include **rubble stone** in list of commodities named in Proposal 610-3 naming basis for joint haul movements within New England announced in Docket Bulletin No. 531 of August 21, 1929.

Sand, Etc., to Illinois

SETTLEMENT of the questions about rates on sand, gravel and crushed stone to southern Illinois from sources of supply in Illinois, Indiana and Missouri in accordance with the agreement between the interested parties or on the basis of an agreement proposed but not made at the conference between shippers, carriers and representatives of the regulating commissions involved has been recommended in a printed report by Examiner Burton Fuller, in No. 21939, sand, gravel and crushed stone from Indiana and Illinois points to destinations in Illinois and the cases joined with it. The additional cases are I. and S. No. 3093, sand, gravel and crushed stone from Indiana points to destinations in Illinois; and No. 21372, Ohio and Indiana Stone Co., et al. v. Big Four, et al.

The orders instituting the title case, the examiner said, brought into issue the lawfulness of the interstate rates on sand, gravel and crushed stone from points in Indiana, on crushed stone from Marquette and Cape Girardeau, Mo., and on chatt from points in Missouri on the Missouri-Illinois railroad and Missouri Pacific to destinations in Illinois on and south of the Terre Haute-St. Louis line of the Pennsylvania, that area being called southern Illinois, the lawfulness of the interstate rates on sand, gravel and crushed stone from points in Indiana on the Toledo, Peoria and Western, and the question of the lawful relationship or relationships between such interstate rates, on the one hand, and the intrastate rates on the like commodities from Illinois producing points to the same destination, on the other.

At the request of the parties concerned the proceedings in the additional cases were discontinued, the general investigation covering the issues raised by them.

This case and three proceedings before the Illinois Commerce Commission, Nos. 17841, 17863 and 18480, were handled by the federal and Illinois commissions under the cooperative plan. The work of proposing a basis for adjusting the rates and working out the rates themselves between hundreds of points was placed in the hands of a committee of 11, three from the carriers and eight from the Illinois and Indiana shippers. That committee met with representatives of the federal and Illinois commissions.

The work of that committee, recommended by Examiner Fuller in this report for adoption by the commission, was submitted to a general conference of those concerned on May 16 and 17. Mr. Fuller said that a few changes were made in the rates recommended. After that the parties stated their positions for purposes of the record.

All the carriers, Mr. Fuller said, except the Chicago and Eastern Illinois and the Louisville and Nashville, and all the shippers except those at Thornton and Chasco, Ill., and in the East St. Louis district, expressed a willingness to establish or to have established the proposed rates from Indiana and Illinois. No agreement, Mr. Fuller said, was reached as to rates from Missouri.

Mr. Fuller said that the procedure under the conference plan had resulted in a record which was complete, concise and to the point, in which many matters in dispute had been ironed out and the remaining matters clearly defined. He added that there was no substantial dispute as to the facts. The trouble was caused by the conflict of interest arising out of the extensive development of Illinois

highways which had created a demand for the materials in question so great as to increase the competition between shippers and carriers that had not existed at the time there was a smaller demand.

After reviewing the proposed adjustment, Mr. Fuller reverted to the lack of agreement as to rates from Missouri. Manifestly, he said, shippers at the Missouri points of origin were entitled to the same consideration as producers in Illinois and Indiana. For example, he said, the joint rate from Bonne Terre to Marion, in connection with the Missouri Pacific, giving due consideration to the transportation conditions, might properly be the same as the single-line rate in connection with the Illinois Central and the Chicago and Eastern Illinois from Lehigh and Thornton, respectively.

The findings recommended by Mr. Fuller condemn both interstate and intrastate rates as unreasonable and unduly prejudicial. In addition, they condemn the Illinois intrastate rates as unjustly discriminatory against interstate commerce and unduly preferential of state commerce. The two sorts of rates are so condemned to the extent they exceed those carried in column B of many tables constituting appendix C. The report is a printed document of 44 pages. The tables showing the rates in column B occupy a large part of the appendix, from page 16 to page 43, both inclusive, and not herewith reproduced.

Mr. Fuller said that sometimes it was necessary to load a car somewhat less than full capacity and that it appeared that the establishment of 90% of the marked capacity of the car as a uniform minimum weight would have only a negligible effect on the average loading. As to what the commission should do, Mr. Fuller said:

An order should be entered effective January 1, 1930, or as soon thereafter as practicable, (1) requiring the establishment and maintenance of the rates prescribed herein (a) from the Missouri points, (b) from the Indiana points and Chasco and Thornton, Ill., in connection with the C. & E. I., (c) from Greencastle, Ind., in connection with the C., B. & Q. and (d) from producing points in the East St. Louis district to Belleville and O'Fallon, Ill., in connection with the L. & N. (2) requiring the cancellation of the schedules of the C. & E. I. under suspension in Investigations and Suspensions No. 3093, first supplemental order, and (3) authorizing the establishment of the interstate rates herein prescribed or approved in connection with the Big Four in lieu of its schedules under suspension under the original order in Investigations and Suspensions No. 3093. It is understood that all the other rates prescribed or approved by the two commissions in these proceedings and not already in effect will likewise become effective January 1, 1930, or as soon thereafter as practicable.

ILLINOIS CENTRAL

From	To Centralia Dist.	Rec.	To Marion Dist.	Rec.	To Murphysboro Dist.	Rec.
Lehigh, Ill.	201	100c	276	112c	265	126c
Merom, Ind.	111	90c	186	112c	176	126c
Krause, Ill.	105	90c	115	85c	90	75c
Cairo, Ill.	113	90c	76	80c	55	75c
Metropolis, Ill.	123	90c	48	75c	75	80c
Anna, Ill.	77	80c	40	75c	29	70c

CHICAGO AND EASTERN ILLINOIS

From	To Mt. Vernon Dist.	Rec.	To Benton Dist.	Rec.	To Marion Dist.	Rec.
Thornton, Ill.	254	101c	276	112c	295	112c
Terre Haute, Ind.	227	101c	249	112c	268	112c
Chasco, Ill.	72	80c	51	75c	31	70c

BIG FOUR

From	To Mt. Carmel Dist.	Rec.	To Harrisburg Dist.	Rec.
Greencastle, Ind.	141	95c	206	108c
Kern, Ind.	136	95c	201	108c
Terre Haute, Ind.	108	90c	173	108c
Cairo, Ill.	135	101c	70	85c

CHICAGO, BURLINGTON AND QUINCY

From	To Centralia Dist.	Rec.	To Herrin Dist.	Rec.
Metropolis, Ill.	119	90c	53	80c
Greencastle, Ind.	175	126c	.....	.....

BALTIMORE AND OHIO R. R.

From	To Salem Dist.	Rec.	To Lawrenceville Dist.	Rec.
Shawneetown, Ill.	101	88c	118	95c
Falling Spgs., Ill.	76	91c	147	113c

MOBILE AND OHIO R. R.

From	To Murphysboro Dist.	Rec.	To Cairo Dist.	Rec.
Krause, Ill.	74	75c	137	90c
Cairo, Ill.	62	75c	.....	.....

SOUTHERN RY.

From	To Centralia Dist.	Rec.	To Mt. Carmel Dist.	Rec.
Milltown, Ind.	176	113c	90	90c
Falling Spgs., Ill.	71	90c	157	126c

LOUISVILLE AND NASHVILLE R. R.

From	To Mt. Vernon Dist.	Rec.	To Carmi Dist.	Rec.
Shawneetown, Ill.	66	90c	64	90c
Evansville, Ind.	86	100c	38	70c
Falling Spgs., Ill.	88	90c	133	110c

MISSOURI PACIFIC RY.

From	To Murphysboro Dist.	Rec.	To Herrin Dist.	Rec.
Chester, Ill.	33	70c	54	80c
Valmeyer, Ill.	72	75c	92	85c
Cairo, Ill.	....	.....	91	80c

MISSOURI-ILLINOIS R. R.

From	To Centralia Dist.	Rec.	To Coultersville Dist.	Rec.
Bonne Terre, Mo.	114	90c	79	90c
Chester, Ill.	74	80c	38	75c

Scale Worked Out Jointly by Producers and Railroads

IN A REPORT proposed by Burton Fuller, attorney-examiner of the Interstate Commerce Commission, he recommends to the Commission, rates on sand, gravel and crushed stone, proposed by representatives of shippers and carriers, be made effective either by definite or specific order of the Commission or by the carriers voluntarily establishing the rates proposed.

This case, known as *Docket 21939, Sand, Gravel and Crushed Stone,* from Indiana and Illinois points to destinations in Illinois, was handled in a unique manner, the commission having expressed a desire it be handled under the so-called "conference plan." Mr. Fuller points out in his proposed report, a committee of 11 members, three from the carriers and eight from Illinois and Indiana shippers, met with representatives of the Interstate and Illinois commissions and after a series of conferences arrived at a tentative recommendation for an adjustment of rates. A number of cases pending before the Interstate and Illinois Commerce Commissions were considered with the general case.

Both examiners, i. e., of the Interstate and Illinois Commerce Commissions worked with the committee and heard their contentions, disputes and arguments, and it is felt the record in the case, due to the unique procedure, is more complete, concise and to the point than could have been developed under the customary formal procedure. In fact, the examiners through their working with the experts who served on the committee, were very fully informed of the complicated rate structure on road-building materials and acquainted with the many ramifications of its basic principles and apprised of the many elements entering into its complicated rate basis and with the knowledge gained were able to iron out many matters in dispute and those left for determination by the respective commissions clearly defined. The procedure in this case, it is also felt, has given the parties a better understanding of each other's problems as affected by the rates in issue.

Mile Scale Not Possible

The examiner in his proposed report deals extensively with the rate structure and carefully analyzes the proposed rates and recognizes the futility of establishing a strict mileage scale of rates if all plants are to be given a reasonable opportunity to compete for traffic.

Rates to representative points recommended in the examiner's report follow in the tables below.

Parties adverse to the examiner's proposed report have until October 28, 1929, to file exceptions, and replies thereto are due November 11, 1929.

Iowa Sand Scale Recommended

IN A REPORT in No. 21755, McGrath Sand and Gravel Co. vs. Santa Fe et al., and a sub-number thereunder, Moline Consumers Co. vs. Burlington, Examiner Burton Fuller has recommended that the Interstate Commerce Commission find rates on sand and gravel, from Chillicothe, Ottawa, Sheridan, Yorkville, Aurora and Moline, Ill., to destination on the Burlington in Iowa unreasonable, and, in certain respects, unduly prejudicial and unjustly discriminatory as between state and interstate commerce. He has recommended the making of rates in accordance with a scale providing for charges up to 440 miles, on a single and joint-line basis.

The scale, in Appendix C, begins with 55 cents per net ton for hauls of 10 miles and

under. It progresses by 5-cent additions for each 10-mile block up to 100 cents for 100 miles and 135 cents for the block between 160 and 170 miles. Then the scale progresses by 30-mile blocks and the addition of 10 cents for each block, reaching 145 cents at the 200-mile block, 185 cents in the block between 290 and 320 miles, 215 cents in the block between 380 and 410 miles and runs out with a rate of 225 cents for the block between 410 and 440 miles. The initial joint-line rate is 75 cents per ton. It progresses with the addition of 5 cents per block for joint-line hauls up to the 135-cent rate for the block from 160 to 170 miles. Beyond 170 miles a 10-cent addition is made for each 30-mile block.

Producers at LaGrange, Mo., Rock Island, Gladstone, Oswego and Joliet, Ill., and at various points in Iowa, and the Northwestern Lumbermen's Association, an association of retailers handling sand, gravel, crushed stone and other building materials, intervened on account of the effect these cases might have upon their interests. The examiner undertakes to care for their interests by means of a suggestion in connection with the following proposed findings:

The commission should find that the rates assailed from the complaining points were unreasonable to the extent that they exceeded rates based on the Iowa interstate scale, and that they are and for the future will be unreasonable to the extent that they exceed or may exceed rates based on the scale set forth in Appendix C.

The commission should further find that the rates assailed are unduly prejudicial to complainants and unduly preferential of Iowa producers and unjustly discriminatory against interstate commerce in favor of intrastate commerce to the extent that the single-line rates from Iowa points for hauls of 30 miles and less to the same destinations represent a smaller percentage of the scale prescribed herein than the rates from the complaining points.

The commission should further find that complainant in No. 21755, Sub-No. 1, made shipments as described and paid and bore the charges thereon and is entitled to reparation in the amount that the charges paid exceeded those which would have accrued at the rates herein found to have been reasonable, with interest. Complainants should comply with Rule V of the Rules of Practice, including therein shipments made since the hearing with an affidavit that the charges made on such shipments were also paid and borne by them.

It is suggested that in order to avoid the creation of undue prejudice the basis herein prescribed for the future be also established from the intervening Missouri and Illinois points, although no finding or order can be made with respect thereto under the issues raised by the complainants. Pursuant to the suggestion made at the hearing, the parties are also asked to indicate in their exceptions whether in the light of this proposed report a conference of the interested carriers and other parties before the examiner would be desirable with a view to reaching an agreement as to the rates which should be applied for the future on this traffic from the Illinois, Missouri and Iowa origins.—*Traffic World.*

Car-Loading Forecast for Last Quarter 1929

SHIPPERS of the country, through estimates of the shippers' regional advisory boards, anticipate that carload shipments of the 29 principal commodities in the fourth quarter of this year (the months of October, November and December) will be approximately 9,134,023 cars, an increase of 209,391 cars above the corresponding period in 1928, or 2.3%, according to the car service division of the American Railway Association.

The shippers' regional advisory boards, covering the entire United States, furnish these estimates quarterly to the car service division so that the railways may have a guide as to the service they are to be called upon to perform in a given quarterly period.

The only boards estimating a decrease are the Great Lakes, Pacific Northwest and Northwestern.

The estimate by each board as to what freight loadings by cars are anticipated for the 29 principal commodities in the fourth quarter this year compared with the corresponding period in 1928, and the percentage of increase or decrease, follows:

Board	Actual, 1928	Estimated, 1929	Per Cent of Increase or Decrease
Central Western	362,758	365,339	0.7
Pacific Coast	361,920	377,245	4.2
Pacific Northwest	317,298	310,581	*2.1
Great Lakes	644,032	633,851	*1.6
Ohio Valley	1,127,107	1,207,035	7.1
Mid-west	1,308,725	1,325,727	1.3
Northwest	520,651	486,360	*6.6
Trans-Missouri-Kansas	461,779	472,233	2.3
Southeast	939,648	957,637	1.9
Southwest	672,834	683,672	1.6
New England	176,670	186,565	5.6
Atlantic States	935,618	966,223	3.3
Allegheny	1,095,592	1,161,555	6.0
Total	8,924,632	9,134,023	2.3

*Decrease.

The estimates for rock products loadings are as follows:

Cement—196,352 cars—4.7% above same quarter of 1928.

Sand, gravel and stone—744,402 cars—1.4% below same quarter of 1928.

Lime and plaster—54,124 cars—1.8% above same quarter of 1928.

Iowa Cement Shippers Complain of Rates to South Dakota

A COMPLAINT has been filed, the South Dakota board of railroad commissioners announced, with the Interstate Commerce Commission by cement mills at Linwood, Des Moines and Valley Junction, Iowa, attacking existing rates on cement to destinations in South Dakota.

The complaint alleges, also, the board explained, that existing rates from Rapid City to South Dakota destinations, prescribed by the South Dakota board, are unduly preferential and that the lower intrastate rates in South Dakota discriminate against interstate consumers.

The board indicated it will intervene for the purpose of avoiding increases in the present South Dakota intrastate rates. It was explained that the present interstate rates from Iowa mills to points in South Dakota were prescribed by the Interstate Commerce Commission, "and if improper differences are found to exist, the readjustment would very probably be accomplished by increasing the South Dakota rates."—*Sioux Falls* (S. D.) *Argus-Leader.*

Medusa Cement Asks New Freight Rates from York, Penn., Plant

THE Medusa Portland Cement Co., West York, Penn., has complained to the Interstate Commerce Commission in objection to the freight rates exacted on cement shipments by the railroads between York and points in New York and New Jersey.

The rates are claimed to be unreasonable and excessive, and when compared with shipments made to the same destinations from competing cement companies' plants in Northampton and points in the Lehigh district, unduly preferential of competitors.

The commission is urged to prescribe reasonable rates for the future to apply on all cement shipments from York to destination within the free lighterage limits of New York. The York company, it is claimed, produces about 750,000 bbl. of cement annually. —*Philadelphia* (Penn.) *Inquirer.*

Third National Fuels Meeting

THE THIRD NATIONAL FUELS MEETING, under the auspices of the American Society of Mechanical Engineers, will be held at Philadelphia, Penn., October 7 to 9, 1929. One paper of special interest to ROCK PRODUCTS readers will be read by Victor J. Azbe, consulting engineer, St. Louis, Mo., on "Fuel Burning in the Ceramic and Lime Industries." Mr. Azbe, who is well-known in the lime industry and is a frequent contributor to ROCK PRODUCTS, is also chairman of the executive committee, Fuels Division, of the American Society of Mechanical Engineers.

September Meeting, New York State Crushed Stone Association

SIXTEEN members of the New York State Crushed Stone Association were in attendance at Syracuse, N. Y., September 27, to take part in the regular monthly meeting. There was no meeting in August, although several members of the association gathered in Albany at that time in anticipation of the scheduled event.

W. L. Sporborg reported on the N. C. S. A. directors' meeting at Atlantic City, advising of the national convention dates decided on at that time.

Mr. Sporborg also reported that an official of the Federal Trade Commission was present at the directors' meeting and discussed with them the adoption of a "Code of Ethics" for trade practice in the crushed stone industry which will be brought before the producers during the Cincinnati convention on a date specifically set aside for such purpose. It was suggested that further information regarding this important subject could be brought before the meeting in October.

A committee was appointed to determine the views of the association on changes in the New York State lien law, and to advise the joint legislative committee, now holding hearings throughout the state, of the wishes of the Association concerning this matter.

The chair appointed A. G. Seitz as chairman and Messrs. Kaiser and Francis Owens, and they will confer with Senator Fearon, chairman of the state legislative committee. The committee was requested to report at the October meeting and in the meantime to take what action they thought best for the Association.

Mr. Schaefer spoke of the frequent confliction of meetings with state highway lettings at Albany and said that in his opinion the failure of some of the members to attend the monthly meetings on such conflicting dates was doubtless due to the desire to attend the highway lettings. He suggested the advisability of considering a change in the monthly meeting dates for next year.

A written suggestion by E. G. Lewis, chairman of the Manufacturers' Division, N. C. S. A., that the New York association hold its next meeting in New York City on October 25, at which time the Manufacturers' Division was to hold its annual meeting also, was accepted by the members. Arrangements for the Association meeting, which include a morning business session, were put in charge of a committee comprising A. G. Seitz, chairman; J. H. Odenbach and G. E. Schaefer. The attending members plan to attend the joint luncheon with the Manufacturers' Division members and the latter body's annual banquet in the evening.

One of the features of the meeting was an able discussion by H. J. Russell of the Jointa Lime Co., Glens Falls, N. Y., on the recent meeting of the National Lime Association to adopt a code of ethics similar to that anticipated for the stone industry.

Mr. Russell is a member of the Lime Association as well as of the Crushed Stone Associations, both local and national.

Those in attendance included:

Attendance

James Savage, President, Buffalo Crushed Stone Co., Buffalo.
A. S. Owens, Secretary, Eastern Rock Products, Inc., Utica.
J. H. Kaiser, Solvay Sales Corp., Syracuse.
H. J. Russell, Jointa Lime Co., Glens Falls.
William McGrew, L. & M. Stone Co., Prospect.
W. L. Sporborg, General Crushed Stone Co., Syracuse.
Grover J. Murphy, General Crushed Stone Co., Little Falls.
F. C. Owens, General Crushed Stone Co., Auburn.
Geo. E. Schaefer, General Crushed Stone Co., Rochester.
W. E. Foote, Wickwire Spencer Steel Corp., Gasport.
John H. Odenbach, Harvey Clark, Walter Sickles, Dolomite Products Co., Rochester.
D. L. Moore and Duane Moore, Le Roy Lime and Crushed Stone Corp., Le Roy.
William Anderson, Hercules Powder Co., Buffalo.

North American Cement Buys Acreage Adjoining Catskill N. Y. Mill

OPTIONS on approximately 153 acres of cement rock property were taken up by the North American Cement Corp. The properties adjoin the company's cement mill at Alsen. In addition, the company option on 200 other acres of land owned by Burton Rogers will be exercised soon, the report states.

The purchase of the land is seen to preclude the possibility of another cement mill locating in the district, rumors to that effect having been circulating. There have been other reports current that the North American company was contemplating enlarging its plant but no plans are being discussed at present about this, it is said. With the passage of a suitable tariff on cement, the output of the plant may be increased.—*Catskill* (N. Y.) *Mail.*

British Lime Manufacturer Visits America

J. P. MILLS, A. I. M. M., managing director, the Stoneycombe Lime and Stone Co., Ltd., Newton Abbot, Devon, England, returned to his home on the S. S. *Majestic* October 4. He spent several weeks in this country visiting American lime and quarry operations. He was particularly interested in American developments in the use of motor trucks for quarry-to-plant transportation. At his plant he is using 6-wheel steam trucks hauling a 16-ton load.

Erie Stone Buys Logansport Lime and Stone Co.

PURCHASE of the Logansport Lime and Stone Co., Logansport, Ind., by the Erie Stone Co. of Huntington, Ind., a subsidiary of the France Stone Co., is announced by Charles W. McKee, president of the Erie company. The consideration was said to be about $175,000.

The purchased property comprises 135 acres, of which only a small part has been developed, a 25-car per day stone crushing plant and a 6-kiln lime plant producing a total of about 300 tons per day. Installation of new equipment and buildings is expected to follow, to increase crushed stone production to 50 cars per day. The stone, a high calcium limestone, suitable for cement manufacture, runs deep and thus it has not been necessary to extend the quarry.

Peter Martin, president of the Logansport company, has announced his intentions of retiring following consummation of the deal. He has been active in the operation of the plant since 1909 and has long been a conspicuous figure in the rock products industry; he was one of the organizers of the Indiana Portland Cement Co., now an International Cement Corp. subsidiary, and was one of the first presidents of the National Lime Association.

The plant organization of the Logansport company will be retained, the report states. This new acquisition is seen as an extension of the France holdings in Indiana, for only a few years ago the Casparis company properties west of Logansport were purchased.

The Medusa Portland Cement Co., Sandusky, Ohio, recently bought the 280 acres adjoining the Logansport quarry.

Texas Quarries, Inc., to Operate Near Austin, Texas

TEXAS QUARRIES, INC., subsidiary of Indiana Limestone Co., has been organized for the purpose of operating extensive limestone quarries near Austin and a stone finishing plant here. The company will spend approximately $250,000 for the installation of machinery and equipment.

More than 4000 acres, rich in limestone deposits, in Williamson and Travis counties, are either under lease or are owned by the company. A small amount has already been quarried near Cedar Park. The quarry is about 24 miles northwest of Austin and accessible by highway.—*Wall Street Journal.*

New Arkansas Gravel Plant

THE Mobley Construction Co. has put in operation a new sand and gravel plant in North Dardanelle, Ark., following a test of all machinery. The plant cost over $50,000 and has a capacity of 10 carloads daily.—*Little Rock* (Ark.) *Gazette.*

Cement Products

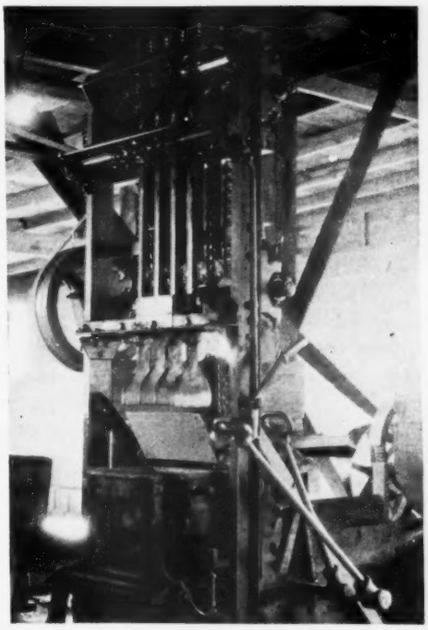
TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Making Limestone Fines Yield Profit

Muncie Stone and Lime Co., Muncie, Ind., Operates a Small Cement Block Plant as a Sideline

MANY OPERATORS of crushed limestone plants are faced with a problem of efficient and economical disposal of fines. True, there is a fair demand for the fine products as agricultural limestone—a demand which by virtue of constant sales effort is continually increasing—but even this is not sufficient to take care of rapidly mounting stockpiles of these fines, a material which in the course of ordinary operation is a good part of the costs and should be made to bear its burden.

The Muncie Stone and Lime Co. operates a small limestone crushing plant at Cornbread road, two miles from Muncie, Ind. Demand in the territory it serves calls for stone 5/8- to 3/4-in., and in its production a goodly amount of fines are produced. This material, 10-mesh to 1/4-in., has a fair market in states where water-bound macadam roads are in good favor, but in and about Muncie the specifications do not permit their use. Consequently, E. T. Milligan, operator of the Muncie company's plant, looked around for a consuming market, and found it, not only as a source of agstone but as aggregate for a concrete block plant built especially for the purpose. So well has he succeeded in disposal of fines that now he is considering putting in another crusher to especially make 5/8- and 3/4-in. stone with a larger percentage of fines than usual.

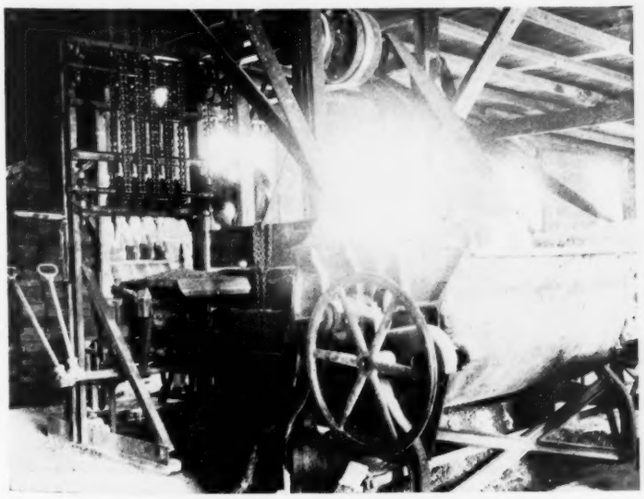


Block machine with tampers in raised position

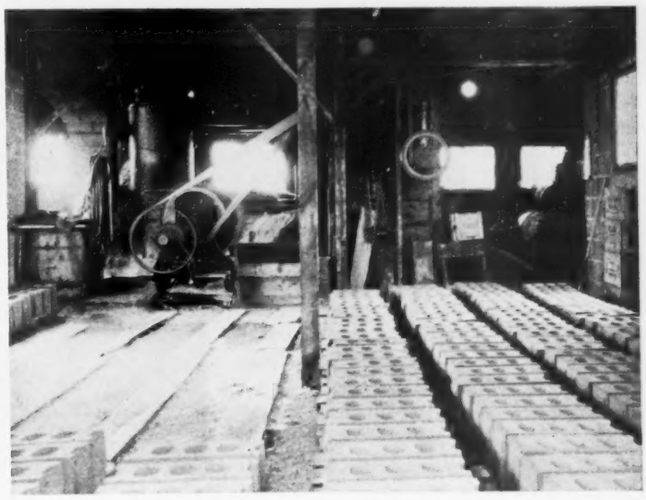
The block plant is not an imposing affair; it is a one-story building made of concrete block produced at the plant. There is one main operating room, in which is placed a semi-automatic Miles Manufacturing Co., Jackson, Mich., face down, power tamper, on which the blocks are made. Close by is a 11-ft. Blystone concrete mixer of the usual type. Both of these machines are operated from a lineshaft driven by a 5-hp. General Electric motor.

The aggregate for the block is the screenings of the commercial stone plant adjacent. This material runs from 10-mesh to 5/8-in., and is reclaimed by a wheelbarrow from outside storage, which is dumped near the mixer and the pile drawn on as needed. The mix of limestone sand and cement is shoveled into the mixer; the whole given a three-minute dry and wet mix and then dumped to the floor and shoveled to the block machine as needed.

Two types of block are made, a rough face for finish block and a smooth panel face



Block machine and concrete mixer



Inside curing floor

Concrete products plant operated by the Muncie Stone and Lime Co., Muncie, Ind.

A pile of finished block in outside storage. E. T. Milligan (right and S. D., his brother, left

for foundations. Both types have dimensions of 8x8x16-in., and some half-block, 8x8x8-in., are also produced. The facing mixture consists of 10-mesh limestone fines, made by hand screening of the usual screenings, to which is added cement. A small steel mixing drum of 2 cu. ft. capacity is used for proper mixing of the facing compound.

In making the block, the facing mixture is first distributed thinly over the facing mold, then the mold is swung into position and the wet mortar shoveled in. The operator throws a clutch and the power tampers ram home the mortar; a one-minute tamp is deemed sufficient. Excess material is screeded off mechanically, a steel plate put over the top and the tamping continued for about one-half minute, after which the steel plate is removed, the block tilted to a wooden pallet and carried off to the inside curing room.

The curing room is an ell off the main plant; on its floor are wooden planks for the pallets and the block to rest on. There is no steam curing, but provisions have been made for heating the room to about 50 deg. F. in the winter or cold weather. The blocks stay in this room for 24 hr., when they are sufficiently hard to be carried to the outside storage, where they are sprayed at intervals during the 28-day period and then are ready for use.

During cold weather, inside curing is lengthened to 48 hr. At the same time the mixing water during cold weather is preheated to about 45 deg.

The cement-aggregate proportions vary, but on an average about 20 blocks, 8x8x16-in. each, are made per bag of cement. The strength of these blocks is best recognized from the recent certified tests made by the city of Indianapolis' testing laboratory. These show that on the standard block made here compressive strengths of 1487 and 1441 lb./in.^{2} were reached respectively on two samples. This is far in excess of the city specifications, which call for only about 800 lb./in.^{2}.

The daily production is from 350 to 400 block per day, requiring but two men for all the work incidental to their production. This production will be increased after the new crusher is installed; probably another block machine will be also put in operation. E. T. Milligan is president of the Muncie Stone and Lime Co., and his brother, S. D., is general superintendent of both plants.

Light Weight Concrete Roofing Tile

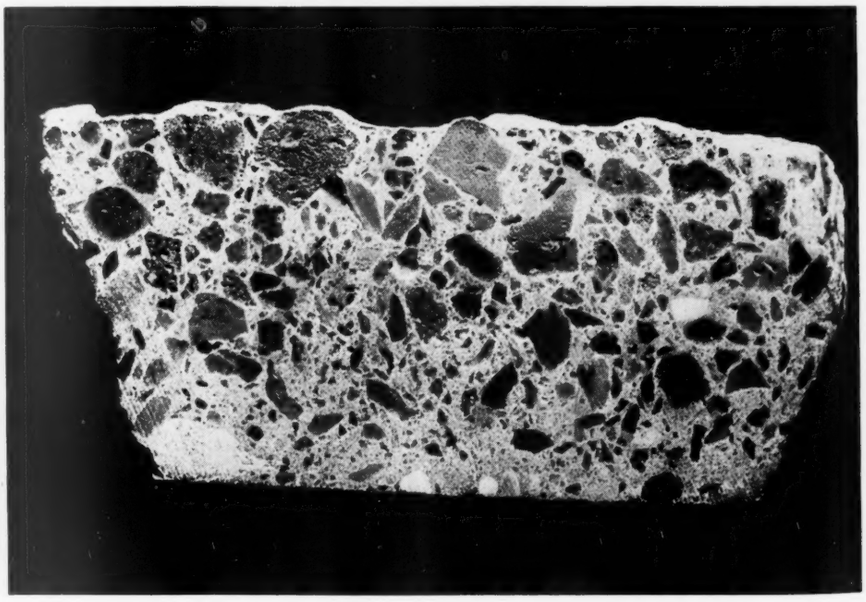
By A. B. Shenk

Engineer, Federal Cement Tile Co., Chicago

ONE of the latest advances in the design and construction of roof-decks as used over the modern industrial or public building, is in the development of light weight concrete roofing tile.

When shale is ground and burned under careful control at a temperature of about 2000 deg. F. in rotary kilns of a type similar to those used in the manufacture of portland cement, the oxidization of the carbon content forms gases and causes the shale to expand into an inert, light weight cellular structure. The result is a mass of trapped air cells, the walls of which are thoroughly vitrified, fused shale, impervious and of great structural strength. This material, known as "haydite," when crushed, screened and graded, is used as an aggregate to produce the newer concrete. Two marked advantages result from the presence of the trapped air cells: (1) the concrete becomes very much lighter in weight than ordinary concrete, yet with the same structural strength, and (2) it possesses a very definite insulating value heretofore unobtainable in concrete.

Roof slabs have been precast of concrete and extensively used for permanent, fireproof, no-maintenance roof-decks for many years on all kinds of buildings. Since they



Cross section of light weight, insulating concrete showing the cellular nature of the aggregate

are laid directly on the steel roof purlins to form the roof-deck, their weight is naturally an important factor in determining the amount and cost of the structural steel used to support the roof.

A sand concrete slab of this kind in channel form, say 6 ft. long by 2 ft. wide, would weight 15 lb. per sq. ft. In haydite concrete, however, this same slab weighs but 10 lb. per sq. ft. or one-third less. It is thus apparent that there is a considerable saving in steel to support a roof-deck of haydite slabs over one of ordinary sand concrete.

In addition to the benefits of light weight, there is also the new insulating quality of haydite concrete, a factor recognized today more than ever before in preventing condensation, and in saving radiation and fuel in the design and operation of the heating plant. Some idea of the practical value of this characteristic may be gained from a comparison of heat conductivity. The coefficient of thermal conductivity (or scientific measure of this factor) for a slab of sand concrete of usual proportions 1 in. thick is 6 B. t. u. temperature per sq. ft. per. deg. F. difference in temperature. The coefficient for a similar slab of haydite concrete with a density of 73.00 is 1.62, indicating the superiority of a roof-deck of this latter type as a heat and cold insulator.

For extreme conditions of heat and humidity, it is, of course, possible to place a layer of additional insulating material such as cork, or the like, over a haydite concrete roof-deck. As a matter of fact, however, there are today thousands of acres of roofs which have given excellent service for years, consisting simply of the sand concrete roof-deck covered with composition covering.

Haydite concrete slabs have been under test in an actual roof for over eight years, and many complete roofs have been in service for two years. In the last few months, however, this product has been put in standard quantity production and given publicity. The response from building interests has been so marked that today over 2,000,000 sq. ft. of these slabs have been contracted for to cover buildings.

The slabs are made under close factory control, laid anywhere in the country, and guaranteed by the Federal Cement Tile Co. of Chicago.

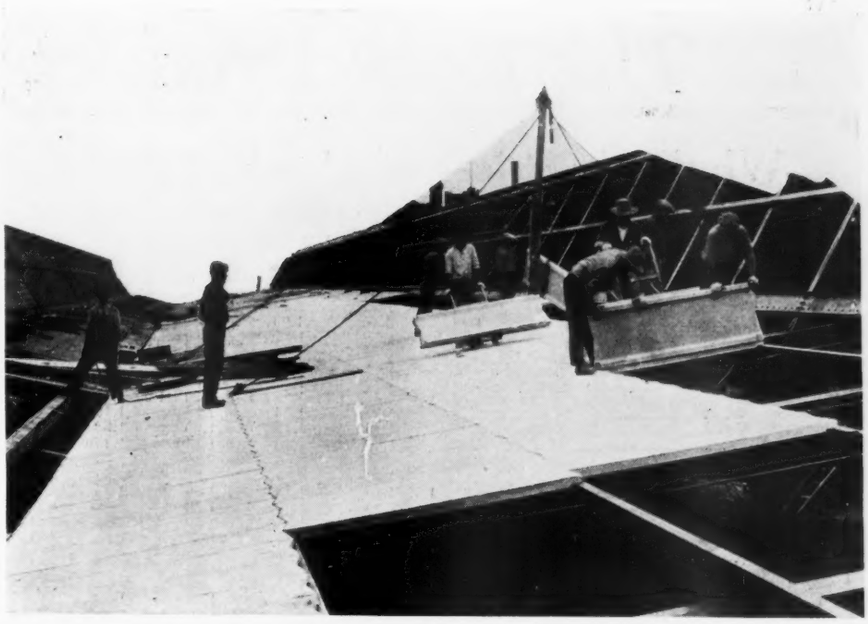
Conflicting Reports on Rebuilding of Burned Bluffton Plant

ERECTION of a modern steel and concrete structure, to replace the recently burned main plant building of the Bluffton, O., quarry plant of the National Lime and Stone Co. will be started as soon as debris is cleared away, according to Frank McElroy, resident superintendent of the National company.

The former wooden structure was valued at more than $300,000, according to officials' estimates, and nearly $350,000 is expected to be expended in the erection of the new building.

The fire at the plant was believed caused by either an overheated bearing on one of the large crushers or through an electrical short circuit.—*Lima* (Ohio) *News.*

Another report from the *Upper Sandusky* (Ohio) *Chief* is in direct conflict with the above. It credits Frank McElroy, superintendent, with the announcement that the damaged plant will be abandoned because of the higher rates at Bluffton as compared with the other eight plants operated by the National company at different places.



Showing the method of laying the roofing tile on the steel purlins after hoisting them from the box cars

Two Fatal Accidents at Gypsum Company's Plants

TWO fatal accidents, almost within a week of each other, occurred recently at the new East Chicago, Ind., mill of the U. S. Gypsum Co. The first of these happened on September 14 and resulted in the death of George Bomberry, 39, an employe of the company for the last 12 years. According to the *Hammond* (Ind.) *Times*, Bomberry, with a helper, went to clean out a large plaster grinding mill, and in some unaccountable way the manhole cover blew off as the lugs were being removed. The cover struck Bomberry in the head, rendering him unconscious and he died of a fractured skull while being taken to the hospital. The deceased had recently come from the U. S. Gypsum Co.'s Fort Dodge, Iowa, plant to become chief maintenance man at the new mill.

The other fatality, reported in the *Indianapolis* (Ind.) *News*, was to Edward Muizys, 16. The worker died on September 25 from internal injuries received when he became caught in a conveyor belt at the East Chicago mill. Fellow workmen were unable to stop the machinery or extract Muizys before he had been fatally crushed between the belt and a large wheel.

To Make Glazed Concrete Tile

THE Regina Duntile Co., Regina, Can., has been organized to manufacture glazed concrete tile, a product which, it is claimed, can be used in place of face brick and can be produced at one-third less cost. The initial plant is to be 100 by 200 ft. and will be veneered with the tile which it is to produce. William Giddings, proprietor of the Capital Coal & Wood Co., Regina, is also proprietor of the new industry, and will operate it in conjunction with his other business. About 10 men will be employed at the outset.

Canadian Plant for Treating Zonolite Planned

A GROUP of Canadian capitalists, including B. D. White of Winnipeg, Man., A. C. Johnson, L. L. Smith and J. L. Butler, all of Calgary, are reported to have had a conference with C. L. Emmons, president of the Zonolite Co., at Libby, Mont., for the express purpose of establishing a Zonolite treating plant at Winnipeg, and placing of finished products on the Canadian market. The establishment of a Canadian plant would give a big saving in tariff payments, the tariff on the finished products naturally being much higher than on the raw material. While in Libby the visitors went over the mine and the local plant of the company and discussed thoroughly contracts for the purchase of the raw material from the Zonolite Co.—*Libby* (Mont.) *Western News.*

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.		1.30	1.30	1.30	1.30	1.30
Bound Brook, N. J.		1.35	2.10	1.90	1.50	1.50
Chaumont, N. Y.		.50	1.75	1.75	1.50	1.50
Chazy, N. Y.		.75	1.75	1.60	1.30	1.30
Dundas, Ont.		.53	1.05	1.05	.90	.90
Farmington, Conn.			1.30	1.10	1.00	1.00
Frederick, Md.		.50– .75	1.35–1.45	1.15–1.25	1.10–1.20	1.05–1.15
Ft. Spring, W. Va.		.35	1.25	1.25	1.25	1.15
Munns, N. Y.		.75	1.15	1.15	1.00	1.00
Prospect, N. Y.		.80	1.00	1.00	1.15u	1.15u
Rochester, N. Y.—Dolomite		1.50	1.50	1.50	1.50	1.50
St. Vincent de Paul, Que. (n)		.65	1.25	1.05	.95	.85
Shaw's Junction, Penn. (e)		.85	1.35–1.60	1.35	1.35	1.35
Syracuse, N. Y.		.50	1.00	1.00	1.00	1.00
Watertown, N. Y.		1.00	1.75	1.75	1.50	1.50
Western New York		.85	1.25	1.25	1.25	1.25
CENTRAL:						
Afton, Mich.					.50	
Alton, Ill.		1.85		1.85		1.50
Cape Girardeau, Mo.		1.00	1.10	1.25		
Columbia and Krause, Ill.		1.05–1.40	.95–1.50	1.15–1.50	1.25 1.05–1.50	1.00 1.05–1.50
Cypress, Ill.		1.60	1.00	1.10	1.00	1.00
Davenport, Iowa (f)		1.00	1.50	1.50	1.30	1.30
Dubuque, Iowa		.95	1.10	1.20	1.10	1.10
Stolle and Falling Springs, Ill.		1.05–1.70	.95–1.70	1.15–1.70	1.05 1.70	1.05–1.70
Greencastle, Ind.		1.25	1.10	1.10	1.10	1.10
Lannon, Wis.		.90	1.00	1.00	.90	.90
McCook and Gary, Ill.		1.00	1.25	1.25	1.25	1.25
Marblehead, Ohio (l)		.55	.80	.80	.80	.80
Northern Ohio points		.85–1.15	1.25	1.15	1.15	1.15
Sheboygan, Wis.		1.10	1.10	1.10	1.10	1.10
Stone City, Iowa		.75		1.20	1.05	1.00
Thornton, Ill.		.90	1.00	1.25	1.25	1.25
Toronto, Canada		2.50	2.50	2.50	2.50	2.50
Valmeyer, Ill. (fluxing limestone)		.90–1.20			1.75	
Waukesha, Wis.			.90	.90	.90	.90
Winona, Minn.		1.00	1.20	1.30	1.40	1.40
Wisconsin points		.50		1.00	.90	.90
Youngstown, Ohio		1.00	1.00	1.25	1.25	1.25
SOUTHERN:						
Cartersville, Ga.		1.00	1.65	1.65	1.35	1.15
Chico, Texas		.50	1.30	1.30	1.25	1.20
Cutler, Fla.			.50– .75r		1.50–1.75r	
El Paso, Texas (r)		.75–1.00	1.00–1.25	1.00–1.25	1.00	1.00
Graystone, Ala.			1.00	1.00	.90	.90
Olive Hill, Ky.			Crusher run, screened, $1 per ton			
Rocky Point, Va.		.50– .75	1.40–1.60	1.30–1.40	1.15–1.25	1.10–1.20
WESTERN:						
Atchison, Kan.		.50	1.80	1.80	1.80	1.80
Blue Springs and Wymore, Neb. (t)		.25	1.45	1.45	1.35c	1.25d
Cape Girardeau, Mo.		1.00	1.25	1.25	1.25	1.00
Rock Hill, St. Louis, Mo.		1.45	1.45	1.45	1.45	1.45

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35		1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	
Chico, Texas	2.50	2.00	1.45	1.20	1.15	
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	2.00	1.55	1.25	1.25	1.25
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.						
Northern New Jersey	.80	1.70	1.45	1.20	1.05	
Richmond, Calif.	1.35–1.40	2.10	1.80–1.90	1.40–1.50	1.40–1.50	
Spring Valley, Calif.	.75		1.00	1.00	1.00	
Springfield, N. J.	.90–1.25	.90–1.25	.90–1.25	.90–1.25	.90–1.25	.90–1.25
Toronto, Canada	1.40	2.00	1.90	1.60	1.60	
Westfield, Mass.	4.70	5.80		4.05		
	.60	1.50	1.35	1.20	1.10	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	
Cayce, S. C.—Granite			1.75	1.60	1.60	
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.—Flint rock			2.25–2.50s			
Lithonia, Ga.—Granite	.60	2.00b	1.75	1.35	1.25	
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.45	
Middlebrook, Mo.	3.00–3.50		2.00–2.25	2.00–2.25	1.50	
Richmond, Calif.—Quartzite	.75		1.00	1.00	1.00	1.25–3.00
Somerset, Penn. (sand-rock)			1.50 to 1.85			
Toccoa, Ga.—Granite	1.50		1.50	1.35	1.30	1.25

(a) Sand. (b) to ½ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Price net after 10c cash discount deducted. (f) High calcite fluxing limestone, 92–98% CaCO, 1.75. (g) Run of quarry. (h) Less 10c discount. (j) Less 10% net ton. (k) Rubble stone. (l) Less .05. (n) Ballast R. R., .90; run of crusher, 1.00. (p) Carload prices. (q) Crusher run, 1.40; ¼-in. granolithic finish, 3.00. (r) Cubic yard. (s) 1-in. and less, per cubic yard. (t) Rip rap, 1.20–1.40 per ton. (u) Less 2%.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 99% $CaCO_3$; .03% $MgCO_3$; 90% thru 100 mesh	5.00
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton, Penn.—100% thru 20 mesh, 60% thru 100 mesh, 45% thru 200 mesh	a5.00
Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh	1.50
Cartersville, Ga.—90% thru 100 mesh, 2.00; 50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.5v
Cypress, Ill.—Analysis, 94-98% $CaCO_3$, 2% $MgCO_3$; 90% thru 100 mesh, 1.35; 50% thru 100 mesh, 1.15; 90% thru 50 mesh, 1.15; 50% thru 50 mesh, 1.05; 90% thru 4 mesh, 1.10; 50% thru 4 mesh	1.00
Danbury, Conn., and West Stockbridge, Mass.—Analysis, 90% $CaCO_3$; 5% $MgCO_3$; fine ground, 90% thru 100 mesh; bulk	3.50
Paper bags	4.75
100-lb. cloth bags	5.25
(All prices less .25 cash 15 days)	
Davenport, Ia.—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 200 mesh, bags, per ton	6.00
90% thru 20 mesh, bulk, per ton	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$; 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89% $CaCO_3$, 4% $MgCO_3$; pulverized; bags, 4.25; bulk	2.75
Joliet, Ill.—Analysis, 52% $CaCO_3$; 48% $MgCO_3$; 90% thru 100 mesh	3.50
Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, bags, 3.75; bulk	2.50
Marlbrook, Va.—Analysis, 80% $CaCO_3$; 10% $MgCO_3$; bulk	1.75
Marl — Analysis, 95% $CaCO_3$; 0% $MgCO_3$; bulk	2.25
Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton	2.00
Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh	4.25
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35–1.60
Olive Hill, Ky.—Analysis, $CaCO_3$ 94-98%; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 101.12%; 60% thru 100 mesh	2.50
100% thru 10, 90% thru 50, 70% thru 100; bags, 5.00; bulk	3.50
100% thru 4, 30% thru 100, bulk	1.50
Rocky Point, Va.—Analysis, $CaCO_3$, 97%; $MgCO_3$, 75%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Sibley, Mich.—Analysis, 87.47% $CaCO_3$; 8.30% $MgCO_3$; 60% thru 100 mesh, bulk, per ton, 2.30; 100-lb. paper bags, f.o.b. Sibley, Mich., per ton	3.75
Watertown, N. Y.—Analysis, 53.72% $CaCO_3$; pulverized; sacks, 4.25; bulk	2.75

(a) Less 50c comm. to dealers per ton.

Agricultural Limestone

(Crushed)

Bedford, Ind.—Analysis, 98% $CaCO_3$; 1% $MgCO_3$; 90% thru 10 mesh	1.50
30% thru 100 mesh	1.50

(Continued on next page)

Agricultural Limestone

Cape Girardeau, Mo.—Analysis, 94½% $CaCO_3$, 3½% $MgCO_3$; 50% thru 50 mesh 1.50

Chico and Bridgeport, Tex. — Analysis, 95% $CaCO_3$; 1.3% $MgCO_3$; 90% thru 4 mesh 1.00–1.25

Charles-Town, W. Va.—Lime Marl—Analysis, 95% $CaCO_3$, 50% thru 100 mesh, bulk, 3.00; including burlap bags 4.50

Colton, Calif.—100% thru 16 mesh, bulk, 4.00; including sacks 5.00

Davenport, Ia.—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 10 mesh, per ton 1.25

90% thru 4 mesh, per ton 1.10

Dubuque, Ia.—Analysis, 34.96% $CaCO_3$; 59.62% $MgCO_3$; 90% thru 50 mesh ..... .95

Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh 1.00

Ft. Spring, W. Va. — Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh 1.50

Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh, sacked 5.00

Kansas City, Mo.—50% thru 100 mesh 1.00

Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh 2.00

Screenings (¼ in. to dust) 1.00

Marblehead, Ohio—90% thru 100 mesh 3.00

90% thru 50 mesh 2.00

90% thru 4 mesh 1.00

McCook and Gary, Ill.—Analysis, 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh ..... .90

Middlepoint, Bellevue, Bloomville, Kenton and Whitehouse, Ohio; Monroe, Mich.; Bluffton, Greencastle and Kokomo, Ind. —85% thru 10 mesh, 25% thru 100 mesh 1.50

Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh 1.50

Mountville, Va. — Analysis, 76.60% $CaCO_3$; $MgCO_3$, 22.83%, 100% thru 20 mesh; 50% thru 100 mesh, paper bags, 4.50; burlap bags 5.00

Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh 1.15–1.70

Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75

West Stockbridge, Mass.—Analysis, 95% $CaCO_3$; 50% thru 50 mesh, bulk 3.50

100 lb. paper bags, 4.25*; cloth 5.25

Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh 2.10

Valmeyer, Ill.—Analysis, 96% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh 1.10–1.70

*Less 25c cash 15 days.

Pulverized Limestone for Coal Operators

Davenport, Ia.—Analysis 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks 6.00

Hillsville, Penn., sacks, 5.10; bulk 3.50

Joliet, Ill.—Analysis, 52% $CaCO_3$; 48% $MgCO_3$; 95% thru 100 mesh; paper bags (bags extra) 3.50

Piqua, Ohio—99% thru 100 mesh, bulk, 3.50; in 80-lb. bags (f.o.b. Piqua) 5.00

Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk 2.25–3.50

Shaw's Junction, Penn.—Analysis, 91.55% $CaCO_3$; 96% $MgCO_3$; 70% thru 100 mesh, bulk 4.50

Waukesha, Wis.—90% thru 100 mesh, bulk 4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Cedarville and S. Vineland, N. J. *1.75–2.25

Cheshire, Mass., in carload lots 5.00–7.00

Estill Springs and Sewanee, Tenn. 1.50

Franklin, Penn. 2.00

Klondike, Mo. 2.00

Massillon, Ohio 3.00

Michigan City, Ind. ..... .30– .35

Ohlton, Ohio 2.50

Ottawa, Ill. 1.25

Red Wing, Minn. 1.50

San Francisco, Calif. 4.00–5.00

Silica and Mendota, Va. 2.50–3.00

St. Louis, Mo. 2.00

Utica and Ottawa, Ill. 75–1.00

Zanesville, Ohio 2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio	.....	1.50
Dresden, Ohio	.....	1.25
Eau Claire, Wis.	4.30	.60–1.00
Estill Springs and Sewanee, Tenn.	1.35–1.50	1.35–1.50
Franklin, Penn.	.....	1.75
Massillon, Ohio	.....	2.00
Michigan City, Ind.	.....	.30

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, Farmingdale. Spring Lake and Wayside, N. J.	.48	.48	1.15	1.25	1.40	.....
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25	.....	2.25	2.25
Buffalo, N. Y.	1.00	1.05	1.05	.....	.....	.....
Erie, Penn.	.70	.90	1.30	1.30	.....	.....
Leeds Jct. and Scarboro, Me.	.....	.....	1.75	.....	1.25	1.00
Machias Jct., N. Y.	.75	.75	.75	.....	.75	.75
Milton, N. H.	.....	.....	1.75	.....	1.25	1.00
Montoursville, Penn.	1.00	.70	.60	.60	.50	.50
Morrisville, Penn.	.50	.40	.90	1.00	1.00	.....
Northern New Jersey	.50	.50	.....	1.25	1.25	.....
South Portland, Me.	.....	1.00	2.25	.....	.....	2.00
Troy, N. Y.	.50– .75*	.50– .75*	.80–1.00*	.80–1.00*	.....	.80–1.00*
F. o. b. boat, per yd.	1.50	1.50	1.75	1.75	.....	1.75
Washington, D. C.	.60	.60	1.20	1.20	1.00	1.00
Georgetown, D. C.	.55	.55	1.20	1.20	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.35	.15	.25	.35	.35	.40
Appleton, Minn.	.....	.50	1.25	.....	1.50	.....
Attica, Ind.			All sizes .75–.85			
Barton, Wis.	.....	.40s	.50s	.65s	.65s	.65s
Chicago, Ill.	.50	.50–1.45n	.60	.60–1.55n	.60	.60–1.90n
Des Moines, Iowa	.60	.60	1.50	1.50	1.50	1.50
Eau Claire, Chippewa Falls, Wis.	.....	.40	.55	.95	.85	.....
Elkhart Lake and Glenbeulah, Wis.	.60	.30	.50	.50	.50	.50
Grand Haven, Mich.	.....	.60	.....	.90	.....	.90
Grand Rapids, Mich.	.50	.50	.90	.80	.70	.70
Hamilton, Ohio	.....	.85	.85	.....	.85	.....
Hersey, Mich.	.....	.50	.....	.60	.70	.70
Humboldt, Iowa	.50	.50	1.40	1.40	1.40	1.40
Indianapolis, Ind.	.50– .75	.40– .60	.50– .75	.50– .75	.60– .85	.60– .85
Mankato, Minn. (h)	.55	.45	1.25	1.25	1.25	1.25
Mason City, Iowa	.....	.60	.85	1.25	1.25	1.25
Mattoon, Ill.			.75–.85 all sizes			
Milwaukee, Wis.	.91	.91	1.06	1.06	1.06	1.06
Minneapolis, Minn. (g)	.35	.35	1.35	1.35	1.35	1.25
St. Louis, Mo. (a)	1.30e	1.30f	1.55t	1.55	1.55	1.65
St. Paul, Minn.	.35	.35	1.25	1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Waukesha, Wis.	.....	.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	.50	1.10	1.10	1.25
SOUTHERN:						
Brewster, Fla.	.50	.50	.....	.....	.....	.....
Brookhaven, Miss.	1.25	.70	1.25	1.00	.70	.70
Charleston, W. Va.	2.00	.....	2.00	2.00	2.00	2.00
Eustis, Fla.	.....	.45– .50	.....	.....	.....	.....
Fort Worth, Texas	.75	.85–1.00	1.00–1.10	1.00–1.10	1.00–1.10	1.00–1.10
Gainesville, Texas	.....	.....	.....	.....	.55	.....
Knoxville, Tenn.	.85	.85	1.50	1.20	1.20	1.20
Macon, Ga.	.65– .90	.65– .90	2.25–2.50	2.25–2.50	2.25–2.50	2.25–2.50
New Martinsville, W. Va.	1.10	1.00	.....	1.30	1.10	.90
Roseland, La.	.30	.30	1.00	.80	.80	.80
WESTERN:						
Kansas City, Mo.	.70– .80	.70– .75	.....	.....	.....	.....
Crushton, Durbin, Kincaid, Largo, Rivas, Calif.	.10– .40	.10– .40	.50–1.00	.50–1.00	.50–1.00	.50–1.00
Los Angeles, Calif.	.10– .40	.10– .40	.20– .90	.50– .90	.50– .90	.50– .90
Oregon City, Ore.			All grades range from 1.00 to 1.50 per cu. yd.			
Otay, Calif.	.....	.35– .40	.50– .60	.50– .60	.50– .60	.50– .60
Phoenix, Ariz. (k)	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.70	.60	.....	1.25	.....	1.15
Seattle, Wash.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Steilacoom, Wash.	.50	.50	.50	.50	.50	.50

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin, Ill.	.....	.....	.....	.....	.....	.30
Appleton, Minn.	.55	.....	.....	.....	.....	.....
Brookhaven, Miss.	.....	.....	.....	.....	.....	.60
Buffalo, N. Y.	1.10	.95	.....	.85	.....	.35
Burnside, Conn.	.75*	.....	.....	.....	.....	.....
Chicago, Ill.	1.25m	.....	.....	.35	.....	.....
Des Moines, Iowa	.....	.....	.....	.85	.....	.....
Dresden, Ohio	.....	.....	.....	.70	.65	.....
Eau Claire, Chippewa Falls, Wis.	.....	.....	.....	.....	.65	.....
Fort Worth, Texas	.....	.....	.....	.....	.....	.67– .75
Gainesville, Tex.	.....	.....	.....	.....	.55	.....
Gary and Miller, Ind.	1.15–1.40p	.....	.....	.....	.....	.....
Grand Rapids, Mich.	.....	.....	.....	.50	.....	.....
Hamilton, Ohio	.....	.....	.....	.....	.70	.....
Hersey, Mich.	.....	.....	.....	.50	.....	.....
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Macon, Ga.	.35	.....	.....	.....	.....	.....
Mankato, Minn.	.70	.....	.....	.....	.....	.....
Oregon City, Ore.	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*
Roseland, La.	.....	.....	.....	.60	.60	.60
Steilacoom, Wash.	.25	.25	.25	.25	.25	.25
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.....	.....	.....	.....	.....	.60
York, Penn.	1.10	1.00	.....	.....	.....	.....

*Cubic yd. ‡Delivered on job by truck. (a) 1½- to ¼-in., 1.65. ‖By truck only. (d) Delivered in Hartford, Conn., 1.50 per yd. (e) Mississippi River. (f) Meramee River. (g) Per yd., delivered by truck, ¼-in. down, 1.25; 2-in. and less, 2.40. (h) ¼- to ¾-in., 1.25. (j) Lake sand, 1.75, delivered. (k) 60-70% crushed boulders. (m) Cu. yd., dune sand, f.o.b. cars, Chicago. (n) Cu. yd., f.o.b. cars, Chicago. (p) Cu. yd., delivered Chicago. (r) Pit run. (s) Plus 15c for winter loading. (t) Fine and regular binder. (u) Coarse, torpedo, also roofing. (v) Coarse binder. †2% discount if paid by 15th of month following delivery.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.00	2.00	2.25			3.75	
Beach City, Ohio	1.75	1.75		1.50	1.50		
Cheshire, Mass.	Sand for soap, 7.00–8.00					6.00–8.00	
Dresden, Ohio	1.25–1.50	1.25–1.50	1.50–1.75	1.00–1.25			
Eau Claire, Wis.						2.50–3.00	
Elco, Ill.	Water floated silica, 92-99½% thru 325 mesh, 18.00–40.00 per ton						
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35–1.50	
Franklin, Penn.	1.75	1.75		1.75			
Kasota, Minn.							1.00
Kerrs, Ohio	1.00–1.50	1.25–2.00	2.00			2.75–3.00	
Klondike, Mo.	2.00			2.00	2.00		
Masillon, Ohio	2.25	2.25		2.25	2.50		
Michigan City, Ind.				.30– .35			
Montoursville, Penn.				1.35–1.50			
New Lexington, Ohio	2.00	1.50					
Ohlton, Ohio	1.75	1.75		2.00	1.75	1.75	
Ottawa, Ill.	1.25	1.25	1.25	1.25	1.25	3.50	3.00
Red Wing, Minn. (d)					1.50	3.00	1.50
San Francisco, Calif.[1]	3.50†	5.00†	3.50†	3.50–5.00†	3.50–5.00†	3.50–5.00†	
Silica, Mendota, Va.	Potters' flint, 8.00–14.00						
Utica and Ottawa, Ill.	.40–1.00f	.40–1.00f	.75–1.00	.40–1.00f	.60–1.00f	2.23–3.25	1.00–3.25
Warwick, Ohio	1.50*–2.00h	1.50*–2.00h		1.50*–2.00h			
Zanesville, Ohio	2.00	1.50	2.00	2.50	2.00		

*Green. †Fresh water washed, steam dried. [1]Core, washed and dried, 2.50. (d) Filter sand, 3.00. (e) Filter sand, 3.00–4.25. (f) Crude and dry. (h) Washed, 1.75.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern New Jersey	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.00	1.00		1.00			
Western Pennsylvania	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio		1.30*		1.45*		1.45*	
Jackson, Ohio	2.05*	1.05*	1.80*	1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.10	1.25	1.25	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	2.05*	1.45*	1.80*	1.45*	1.45*	1.45*	
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	.75	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05	.55*		1.15*	.90*	.90*	

5c per ton discount on terms. †1¼ in. to ¼ in., $1.05; ⅝ in. to 10 mesh, $1.25*; ⅝ in. to 0 in., .90*; ¼ in. to 10 mesh, .80*.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00			17.50		2.00
Buffalo, N. Y.				12.00				
Lime Ridge, Penn.							5.00	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00[13]
Williamsport, Penn.	10.00–11.00	8.50–9.00	8.50–9.00		7.00	9.00	5.00	
York, Penn., & Oranda, Va.	11.50[7]	8.50–9.50[7]	8.50–9.50[7]	8.50–10.50[7]	8.00	9.25	7.00	1.40[8]
CENTRAL:								
Afton, Mich.						10.75	7.50	12.11
Carey, Ohio	11.50	7.50	7.50		8.00		7.50	1.50
Cold Springs, Ohio		6.50	6.50					
Gibsonburg & Whiterock, O.	9.50		6.50		8.00	10.00		
Huntington, Ind.		6.50	6.50					
Luckey, Ohio	11.50							
Marblehead, Ohio		6.50	6.50				7.00	1.50[3]
Milltown, Ind.		8.50–10.00		10.00[8]			8.50[22]	1.35[10]
Ohio points	11.50	7.50	7.50	12.00	8.00	11.00[23]	7.50	1.50[10]
Scioto, Ohio	10.50	7.50	7.50	8.50	8.00	.62½	7.00	1.50
Sheboygan, Wis.		10.50	10.50	10.50			9.50	2.00
Tiffin, Ohio					8.00	10.00		
Wisconsin points[6]		11.50					9.50	
Woodville, Ohio[26]	9.50	6.50	6.50	10.50[24]	8.00	10.00[9]	8.00	1.40[8]
SOUTHERN:								
El Paso, Texas							7.00	1.50
Frederick, Md.		8.00–9.50	8.00–9.50			9.50[15]	7.00[15]	
Graystone & Landmark, Ala.	12.50	9.00		12.50	8.50		7.50	1.35
Keystone, Ala.	17.00	9.00	9.00	8.00–12.00			6.00[21]	1.35
Knoxville, Tenn.	17.00	9.00	9.00	9.00	7.50	.62½	7.50	1.35
Ocala, Fla.	12.00	11.50						1.40
WESTERN:								
Kirtland, N. M.							15.00	
Los Angeles, Calif.	15.00	14.00	12.00	18.00			13.50	
San Francisco, Calif.	19.50	15.00	13.00	15.00–19.00	14.50[20]	.90[17]	14.50[19]	1.85[17]
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

[1] Barrels. [2] Net ton. [3] Wooden, steel, 1.60. [5] Dealers' prices, net 30 days less 25c discount per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days. [7] In paper bags, including bags. [8] To 11.00. [9] 80-lb. [10] In bags. [11] Refuse or air slack, 10.00–12.00. [12] To 3.00. [13] Delivered in Southern California. [15] To 8.00. [16] To 1.70. [17] Less credit for return of empties. [18] 90-lb. sacks. [19] To mortar plant and large industrials, 13.00. [20] Also 13.00. [21] To 8.00. [22] To 9.00. [23] Per bbl., 2.15. [24] Superfine, 99.25% thru 200 mesh. [25] To 16.50. [26] General purpose hydrated lime in 10-lb. paper sacks, 12.50 per ton.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Montoursville, Penn.		1.25
Ohlton, Ohio	1.75	1.75
Ottawa, Ill.	3.25	1.25
Red Wing, Minn.		1.00
San Francisco, Calif.	3.50	3.50
Silica, Va.		1.75
Utica and Ottawa, Ill.	1.00–3.25	.75
Warwick, Ohio		2.00
Zanesville, Ohio		2.50

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:
- Crude talc, per ton 5.00
- Ground talc (20-50 mesh), bags 7.50
- Ground talc (150-200 mesh), bags 10.00
- Pencils and steel crayons, gross 1.50– 2.50

Chester, Vt.:
- Ground talc (97-99½% thru 200 mesh, paper or burlap bags, bags extra 7.50– 8.50
- Same, including 50-lb. Kraft paper bags 8.50– 9.50
- Same, including 50-lb. bags 9.00– 9.50

Chicago and Joliet, Ill.:
- **Ground (150-200 mesh), bags 30.00**

Clifton, Va.:
- Crude talc, per ton 4.00
- Ground talc (150-200 mesh), in bags 12.00

Conowingo, Md.:
- Crude talc, bulk 4.00
- Ground talc (150-200 mesh), in bags 14.00
- Cubes, blanks, per lb .10

Emeryville, N. Y.:
- Ground talc (200 mesh), bags 13.75
- Ground talc (325 mesh), bags 14.75

Hailesboro, N. Y.:
- **Ground talc (300-350 mesh) in 200-lb. bags 15.50–20.00**

Henry, Va.:
- Crude (mine run) 3.50– 4.50
- Ground talc (150-200 mesh), bags 7.50–13.00

Joliet, Ill.:
- **Ground talc (200 mesh) in bags:**
- **California white 30.00**
- **Southern white 20.00**
- **Illinois talc 10.00**
- **Crude talc 3.75**

Keeler, Calif.:
- **Ground (200-300 mesh), bags 20.00–30.00**

Los Angeles, Calif.:
- Ground talc (150-200 mesh) in bags 15.00–24.00

Natural Bridge, N. Y.:
- **Ground talc (300-325 mesh), bags 12.00–15.00**

(a) Bags extra.

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

- Columbia, Tenn.—B.P.L. 65-70% 3.50– 4.50
- Gordonsburg, Tenn.—B.P.L. 68-70% 3.75–4.25
- Mt. Pleasant, Tenn.—B.P.L., 75% 6.50
- **Tennessee — F.o.b. mines, gross ton, unground brown rock, B.P.L. 72% 5.00**
- **B.P.L. 75% 6.00**
- **Twomey, Tenn.—B.P.L. 65%, 2000 lb. 8.00– 9.00**

Ground Rock

(2000 lb.)

- Centerville, Tenn.—B.P.L. 65% 8.00
- Gordonsburg, Tenn.—B.P.L. 65–70% 3.75– 4.50
- **Mt. Pleasant, Tenn.—Lime phosphate:**
- B.P.L., 73%. 80% thru 300 mesh 11.80
- Mt. Pleasant, Tenn.—B.P.L., 72% 5.00– 5.50
- **Twomey, Tenn.—B.P.L. 65% 8.00**
- **Wales, Tenn.—B.P.L. 65% 11.00**

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

- Florida—F.o.b. mines, gross ton, 68/66%
- B.P.L., Basis 68% 3.25
- 70% min. B.P.L., Basis 70% 3.75

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

- Bedford, N. Y.—Mine scrap 12.50–14.70
- **New York City, N. Y.—Per lb.,**
- **Cut mica (1½x2) 1.60**
- **Cut mica (8x10) 26.00**
- **Pringle, S. D.—Mine run, per ton 125.00**
- **Punch mica, per lb .06**
- **Scrap, per ton, carloads 20.00**
- **Rumney Depot, N. H.—Per ton,**
- Mine run 300.00–360.00
- Clean shop scrap 27.50–29.00
- Mine scrap 22.50
- Roofing mica a37.50–40.00
- Punch mica, per ton 200.00–240.00
- Trimmed mica, per ton, 40 mesh, 42.50–45.00; 100 mesh, 60.00; 200 mesh 100.00
- Trenton, N. J.—Mine scrap, per ton 20.00
- Clean shop scrap, per ton 22.00

(a) Also 38.00–42.50 per ton.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream, and American Botticino, coral pink, pearl blush	¶12.50–‖14.50	¶12.50–‖14.50
Brighton, Tenn.—Pink marble chips	$3.00	$3.00
Crown Point, N. Y.—Mica Spar	¶9.00–‖12.00	
Davenport, Ia.—White limestone, in ba	6.00	6.00
Easton, Penn.—Royal green	16.00–20.00a	
Harrisonburg, Va. — Bulk marble (crushed, in bags)	12.50–14.00	12.50–14.00
Ingomar, Ohio — Concrete facings and stucco dash		11.00–18.00
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt. — Middlebury white	‖9.00–¶10.00	
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50
Phillipsburg, N. J.—Royal green granite		15.00–18.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Stockton, Calif.—"Nat-rock" roofing grits		12.00–20.00
Tuckahoe, N. Y.—Tuckahoe white	8.00	
Warren, N. H.		7.90– 8.40
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00
Whitestone, Ga.	b5.00	

¶C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb.

Soda Feldspar

DeKalb Jct., N. Y.—Color, white; pulvertized, 200 mesh, in bags, per ton, 22.00, bulk 20.00; 140 mesh, in bags, ton, 20.00; bulk 18.00

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140-mesh 19.00

Bedford Hills, N. Y.—Color, white; analysis, K_2O, 12.26%; Na_2O, 2.86%; SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; pulverized 78% thru 100 mesh, bulk, 11.00–14.00; crude, bulk, per ton 9.00

Coatesville, Penn.—Color, white; analysis, K_2O, 12.30%; Na_2O, 2.86% SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; crude, per ton .800

Trenton, N. J.—White; analysis, K_2O, 13-14%; Na_2O, 2-2½%; SiO_2, 64-65%; Fe_2O_3, 0.07%; Al_2O_3, 18.50-19.25%; pulverized, 97% thru 325 mesh, crude, 8.50 per ton, ground 21.00

Rochester, N. Y. 22.00

Rumney and Cardigan, N. H.—Color, white; analysis, K_2O, 9-12%; Na_2O, trace; SiO_2, 64-67%; Al_2O_3, 17-18%, crude, bulk 7.00– 7.50

Rumney Depot, N. H.—Color, white; analysis, K_2O, 8-13%; Na_2O, 1-1½%; SiO_2, 62-68%; Al_2O_3, 17-18%, crude, bulk 7.00– 7.50

Penland, N. C.—White; crude, bulk 8.00
Ground, bulk 16.50

Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; pulverized, bulk 18.00
(Bags 15c extra.)

Tennessee Mills—Color, white; analysis, K_2O, 10%; Na_2O_3, 3%; SiO_2, 68%; 99½% thru 200 mesh; bulk (Bags, 15c extra) 18.00

Chicken Grits

Afton, Mich.—(Limestone), per ton	1.75
Centerville, Iowa	9.25
Chico, Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per ton	10.00
Coatesville, Penn.—(Feldspar), per ton, in bags of 100 lb. each	8.00
Danbury, Conn.; Adams, Ashley Falls, and West Stockbridge, Mass.—(Limestone)	‡7.50–*9.00
Davenport, Ia.—(Limestone), bags, per ton	6.00
Easton, Penn.—In bags	8.00
El Paso, Tex.—Per ton	1.00
Knoxville, Tenn.—Per bag	1.25
Los Angeles, Calif.—Per ton, including sacks:	
Feldspar	14.00
Gypsum	7.50– 9.50
Marion, Va.—(Limestone), bulk, 5.00; bagged, 6.50; 100-lb. bag	.50
Middlebury, Vt.—Per ton (a)	10.00
Piqua, O. (b)—(Pearl Grit), fine and medium, per ton	¶8.00
Randville, Mich.—(Marble), bulk	6.00
Rocky Point, Va.—(Limestone), 100-lb. bags, 50c; sacks, per ton, 6.00; bulk	5.00
Seattle, Wash.—(Gypsum), bulk, ton	10.00
Tuckahoe, N. Y.	8.00
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.	7.50– 9.00
Wisconsin Points—(Limestone), per ton	15.00
Winona, Minn.—(Limestone), sacked, per ton, 8.00; bulk, per ton	6.00

*L.C.L. †Less than 5-ton lots. ‡C.L. ¶100-lb. bags. (a) F.o.b. Middlebury, Vt. (b) F.o.b. Piqua, Ohio.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	11.00
Barton, Wis.	10.50
Boston, Mass.	17.00*
Brighton, N. Y.	19.75*
Dayton, Ohio	12.50–13.50
Detroit, Mich. (h)	j13.00–16.00*d
Farmington, Conn.	16.00
Flint, Mich.	18.00†
Grand Rapids, Mich.*	14.00–15.00
Hartford, Conn.	13.00–17.00*
Jackson, Mich.	13.00
Lakeland, Fla.	10.00–11.00
Lake Helen, Fla.	8.50– 9.00
Madison, Wis.	12.50a
Mishawaka, Ind.	11.00
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	15.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00–22.50
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	12.50
Sebewaing, Mich.	12.50
Sioux Falls, S. Dak.	13.00
South River, N. J.	13.00
South St. Paul, Minn.	9.00
Syracuse, N. Y.	18.00–20.00
Toronto, Canada (r)	12.50–15.00g
Wilkinson, Fla.	12.00–16.00
Winnipeg, Canada	15.00

Delivered on job. ‖Dealers' price. (a) Less 50c disc. per M, 10th of month. (d) 5% disc., 10th of month. (f) In yard, 12.00, 12.25 and 12.50. (g) Delivered in city. (h) Also 15.50. (j) Also 14.00. (r) Also 12.00.

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00

Note—Bags extra and returnable for full credit.

Portland Cement

	Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.78¾	3.45	.....
Atlanta, Ga. (1) (2)	.....	2.11	3.01¶
Baltimore, Md. (1)	.....	2.26	3.56¶
Birm., Ala. (1) (2)	.....	1.75	2.73¶
Boston, Mass.	.44½	‡1.78–1.88	3.27¶
Buffalo, N. Y.	.48¾	‡1.95–2.05	3.35¶
Butte, Mont.	.90¼	3.61	.....
Cedar Rapids, Ia.	.....	2.04	2.99f
Charleston, S. C. (2)	.....	2.40b	3.15¶
Cheyenne, Wyo.	.59	2.66	.....
Chicago, Ill.	.....	1.85	3.15¶
Cincinnati, Ohio	.....	1.92	3.22¶
Cleveland, Ohio	.....	1.94	3.24¶
Columbus, Ohio	.....	1.92	3.22¶
Dallas, Texas	.....	1.80	3.39¶
Davenport, Iowa	.....	2.04	.....
Dayton, Ohio	.....	1.94	3.24¶
Denver, Colo.	.63¾	2.55	.....
Des Moines, Iowa	.....	2.14	2.99f
Detroit, Mich.	.....	1.95	3.25¶
Duluth, Minn.	.....	1.84	.....
Houston, Texas	.....	1.90	3.63¶
Indianapolis, Ind.	.54¾	1.89	f2.84–3.19¶
Jack., Miss. (1) (2)	.....	2.19	3.09¶
Jacksonville, Fla. (1) (2)	.....	2.36	3.26¶
Jersey City, N.J. (1)	.....	2.23	3.43¶
Kansas City, Mo.	.45½	1.82	f2.87–3.22¶
Los Angeles, Calif.	.51½	1.82	.....
Louisville, Ky.	.55½	1.82	f2.92–3.22¶
Memphis, T'n. (1) (2)	.....	2.19	f2.69–3.09¶
Milwaukee, Wis.	.....	2.00	3.30
Minneapolis, Minn.	.....	2.02	.....
Montreal, Que.	.....	1.60	.....
New Orleans, La.	.45½	‡1.88(1)	3.18¶
New York, N.Y. (1)	.43¾	2.23	3.33¶
Norfolk, Va.	.....	1.79	3.27¶
Oklahoma City, Okla.	.57¼	2.16	3.56¶
Omaha, Neb.	.54	2.01	3.49¶
Peoria, Ill.	.....	2.02	.....
Pittsburgh, Pa. (1)	.....	2.25	3.35¶
Philadelphia, Pa. (1)	.....	2.25	3.45¶
Phoenix, Ariz.	.....	3.51	.....
Portland, Ore. (2)	.....	2.40	.....
Reno, Nev. (2)	.....	2.82	.....
Richmond, Va.	.....	1.90	3.40¶
Salt Lake City, Utah	.70¼	2.81	.....
San Francisco (1) (2)	.....	2.60	.....
Savannah, Ga. (2)	.....	2.36a	3.15¶
St. Louis, Mo.	.48¾	1.70	f2.65–3.00¶
St. Paul, Minn.	.....	2.02	.....
Seattle, Wash.	.....	†2.50–2.65j	k3.50†
Tampa, Fla. (1) (2)	.....	2.40	3.30¶
Toledo, Ohio	.....	2.03	3.33¶
Topeka, Kan.	.50¼	2.01	3.41¶
Tulsa, Okla.	.53¼	2.03	3.43¶
Wheeling, W.Va. (1)	.....	2.32	3.42
Winston-Salem, N. C.	.....	1.84	3.34¶
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Albany, N. Y.	.....	2.15	.....
Bellingham, Wash.	.....	2.35†	.....
Buffington, Ind.	.....	1.60	.....
Chattanooga, Tenn.	.....	2.05	.....
Concrete, Wash.	.....	2.35	.....
Davenport, Calif.	.....	2.05	.....
Hannibal, Mo.	.....	1.90	.....
Hudson, N. Y.	.....	1.75	.....
Leeds, Ala.	.....	1.65	.....
Lime & Oswego, Ore.	.....	2.50‡	.....
Mildred, Kan.	.....	2.35	.....
Nazareth, Penn.	.....	2.15	.....
Northampton, Penn.	.....	1.75	.....
Richard City, Tenn.	.....	2.05	.....
Steelton, Minn.	.....	1.65	.....
Toledo, Ohio	.....	2.20	.....
Universal, Penn.	.....	1.60	.....

NOTE—Add 40c per bbl. for bags. †10c disc., 10 days. ‡10c disc., 15 days. (a) With bags, 11c refund for paid freight bill. (b) With bags, 15c bbl. refund for paid freight bill. (1) Includes cloth bags at 40c. (2) 10c cash disc., 10c dealer discount. (f) "Velo" cement, including cost of paper bag, 10c disc. 10 days. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c disc. 15 days. (j) 25c bbl. disc. 10 days. (k) "Velo" cement, add 20c per bbl. for paper bags.

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ⅜x32x 36". Per M Sq. Ft.	½x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
Acme, Tex.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Blue Rapids, Kan.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Centerville, Iowa	.....	.....	6.00	7.00	.....	7.50	8.50	10.50e	.....	.....	.....	.....	.....

East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton; floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 3 in. long, 17c per ft., 23.00 per ton.

Ft. Dodge, Iowa; N. Holston, Va.; Akron, N. Y.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Grand Rapids, Mich.	.....	.....	7.00m	.....	8.00m	8.00m	19.85g	8.00m	29.25o	21.00m	.....	15.00	22.50
Los Angeles, Calif. (f)	6.50–7.50	6.50–7.50	7.50–9.00	13.10–14.10	.....	14.10	.....	26.00	.....	.....	.....	.....	.....
Medicine Lodge, Kan.	.....	.....	.....	.....	.....	.....	.....	.....	15.00y	.....	.....	.....	.....
Portland, Colo.	.....	7.00	7.00	9.00	9.00	9.50	9.00	.....	27.50	.....	22.50	27.50	.....
Providence, R. I. (x)	.....	.....	.....	12.00–13.00o	.....	.....	.....	.....	.....	.....	.....	.....	.....
Seattle, Wash. (z)	6.00	9.00	9.00	13.00	.....	.....	14.00	.....	.....	.....	.....	.....	.....
Winnipeg, Man.	5.00	.....	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00w	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable), (a) Hardwall plaster, 13.00; casting, finishing molding, 14.00; (b) Calacoustic plaster, 10.00 at mill; (c) Plaster lath; (d) ¼x48x36 in.; (e) white molding; (f) plasterboard, 18½c to 25c sq. yd.; (g) Satin Spar, in paper bags; (m) includes paper bags; (o) includes jute sacks; (u) includes sacks; (v) retail, 35.00; (w) 16x48; (x) "Fabricaste" gypsum blocks, 2-in., 7c-8c per sq. ft. Block setting plaster, per ton, in jute sacks, 12.00. (y) Jute sacks, 18.00; paper sacks, 16.00. (z) Gypsum partition tile, 3-in., 9c per sq. ft.; 4-in., 11c per sq. ft.

Market Prices of Cement Products and Slate

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

City or shipping point	Size 8x8x16
Camden, N. J.	16.50
Cement City, Mich.	55.00¶
Chicago District‖	180.00–210.00a
8x10x16	230.00–260.00a
8x12x16	280.00–330.00a
Columbus, Ohio	15.00c– 17.00†
Detroit, Mich. (d)	.15– .17†
Forest Park, Ill.	21.00*
Grand Rapids, Mich.	11.00*
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12a
Los Angeles, Calif.	4x8x12–5.00*
Olivia and Mankato, Minn.	9.50b
Tiskilwa, Ill.	.16– .18†
Yakima, Wash.	20.00*

*Price per 100 at plant. †Rock or panel face. ‡Delivered. ¶5x8x12, 55.00 per 1000. (a) Face. (b) Per ton. (c) Plain. (d) 8x12x16, rock or panel face, .24–.26.

Cement Building Tile

Camden and Trenton, N. J.:	
3x8x16, per 100, 9.00; 3x9x16, per 100	9.00
4x8x16, per 100, 12.00; 4x9x16, per 100	13.00
6x8x16, per 100, 16.50; 6x9x16, per 100	15.50
Cement City, Mich.:	
5x8x12, per 100	5.00
Chicago District (Haydite):	
4x 8x16, per 100	13.00
8x 8x16, per 100	20.00
8x12x16, per 100	28.00
Columbus, Ohio:	
5x8x12, per 100	6.00
Detroit, Mich.:	
5½x8x12, per M	75.00
Grand Rapids, Mich.:	
5x8x12, per 100	6.00
Longview, Wash.:	
4x6x12, per 100	5.00
4x8x12, per 100	6.25
Mt. Pleasant, N. Y.:	
5x8x12, per M	78.00
Houston, Texas:	
5x8x12 (Lightweight), per M	80.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00– 40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00– 50.00
Camden & Trenton, N. J.	17.00	.....
Chicago District "Haydite"	14.00	.....
Columbus, Ohio	16.00	17.00
El Paso, Tex.—Klinker	10.00	.....
Ensley, Ala. ("Slagtex")	12.50	.....
Eugene, Ore.	25.00	35.00– 75.00
Forest Park, Ill.	.....	37.00
Friesland, Wis.	22.00	32.00
Longview, Wash.*	15.00	22.50– 65.00
Los Angeles, Calif.	12.50	.....
Milwaukee, Wis.	14.00	20.00– 50.00
Mt. Pleasant, N. Y.	.....	14.00– 23.00
Omaha, Neb.	18.00	30.00– 40.00
Pasadena, Calif.	10.00	.....
Philadelphia, Penn.	15.50	.....
Portland, Ore.	15.00	27.50–112.00
Mantel brick—100.00–150.00		
Prairie du Chien, Wis.	14.00	22.00–25.00
Rapid City, S. D.	18.00	30.00– 40.00
Waco, Texas	16.50	32.50–125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	.....

*40% off List.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.:	
Red	15.00
Green	18.00
Cicero, Ill.—French and Spanish tile (red, orange, choc., yellow, tan, slate, gray) per sq., 9.50–10.00; green or blue, per sq.	11.50–12.00
Detroit, Mich.—5x8x12, per M	67.50
Houston, Texas—Roofing Tile, per sq.	25.0c
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile):	
3½x6x12, per M	50.00
3½x8x12, per M	60.00
Prairie du Chien, Wis.:	
5x8x12, per M	82.00
5x4x12, per M	46.00
5x8x6 (half-tile), per M	41.00
5x8x10 (fractional), per M	82.00
Yakima, Wash. (Building Tile):	Each
5x8x12	.10

Stone-Tile Hollow Brick

Prices are net per thousand f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.	.....	53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.	.....	55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans, La.	35.00	45.00	60.00
Norfolk, Va.	35.00	50.00	65.00
Passaic, N. J.	35.00	50.00	65.00
Patchogue, N. Y.	.....	60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% disc.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200 mesh (94-96% thru 300 mesh), $7.00 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton.
Pen Argyl, Penn.—Blue-black, 6.50 per ton.
Granville, N. Y.—Red, green and black, $7.50 per ton.

Roofing Slate

Prices per square—Standard thickness.

City or shipping point:	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—Buckingham oxford grey	13.88	19.44	24.99	29.44	34.44	45.55
Bangor, Penn.—No. 1 clear	10.50–14.50	24.50	29.00	33.50	44.50	55.60
No. 1 ribbon	9.00–10.25	20.00	24.50	29.00	40.00	51.25
Gen. mediums	9.50–11.25	.....	.....	.....	.....	.....
No. 2 ribbon	6.75– 7.25	.....	.....	.....	.....	.....
No. 1 Albion clear	7.25–10.50	16.00	23.00	27.00	37.00	46.00
Albion mediums	8.00– 9.00	.....	.....	.....	.....	.....
Chapman Quarries, Penn.—No. 1	8.50–11.25	(Vari-tone, 12.00–13.00)				
Medium	7.75– 9.00	.....	.....	.....	.....	.....
Hard vein	.....	16.00	23.00	26.00	32.00	40.00
Granville, N. Y.—Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green and gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple and unfading green	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Monson, Maine	19.80	24.00	.....	.....	.....	.....
Pen Argyl, Penn.*						
Graduated slate (blue)	.....	16.00	23.00	27.00	37.00	46.00
Graduated slate (grey)	.....	18.00	25.00	29.00	39.00	48.00
Color-tone	11.50–12.50; Vari-tone, 12.00–13.00; Cathedral gray, 14.00–15.00					
No. 1 clear (smooth text)	7.25–10.50; No. 1 clear (rough text), 8.25–9.50					
Albion-Bangor medium	8.00–9.00; No. 2 clear, 8.00–9.00; No. 1 ribbon, 8.00–8.50					
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1 clear	9.50	18.00	22.00	26.00	36.00	46.00
Blue Mountain No. 2 clear	8.00	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.
*Unfading grey, 10.50–12.50; textural, 12.00–15.00; 10% disc. to roofer; 10%–8⅓% to wholesaler.

Cement Drain Tile

Graettinger, Iowa.—Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in., 1.35; 36-in.	2.00
Longview, Wash.—Drain tile, per foot: 3-in., .05; 4-in., .06; 6-in., .10; 8-in., .15; 10-in.	.20
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile, per 100 ft.	
3-in.	4.00
4-in.	5.00
6-in.	7.50
8-in.	10.00
Waukesha, Wis.—Drain tile, per ton	8.00

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10 in.	12 in.	15-in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich. (c)																	
Sewer	.10	.12	.22	.30	.40	.60	.90	1.20	.....	1.75	2.00	2.50	3.30	4.50	5.75	6.50	8.00
Culvert	.....	.....	.....	.....	.95	1.25	1.60	.....	.....	2.25	2.50	3.00	3.50	5.00	6.50	8.00	10.00
Grand Rapids, Mich. (b)	.....	.....	.....	.60	.70	.90	1.20	.....	.....	1.80	2.10	2.35	3.50	4.00	5.60	6.90	7.85
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	1.70†	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.75	.85	.90	1.15	.....	.....	1.60	.....	2.50	.....	.....	.....	.....	.....
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.	6 in. to 24 in., 18.00 per ton																
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Tiskilwa, Ill. (rein.)	.....	.....	.....	.75	.85	.95	1.20	1.60	.....	2.00	.....	2.75	3.40	.....	6.50	.....	10.00
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	.85½	.....	1.14	.....	.....	1.81	.....	2.47	3.42	4.13	5.63	6.49	7.31
Yakima, Wash.	.....	.....	.....	.....	.....	.....	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78

(a) 24-in. lengths. (b) Reinforced (c) Delivered on job: 5% discount, 10th of month. †21-in. diameter. ‡Price per 2-ft. length.

Sand-Lime Brick Production and Shipments in September

THE following data are compiled from reports received direct from 17 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is one less than those furnishing statistics for the August estimate published in the September 14 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having about one-half the production capacity in the United States and Canada.

As the building season draws to a close, the effect on the sand-lime brick industry is noticed in the decreased production figures shown for September as compared to those for August, which have been revised to include the figures from two plants received too late for inclusion with the August statistics. Shipments by rail showed a decrease, as did truck shipments. Stocks on hand remain about the same, and unfilled orders increased somewhat.

The following are average prices quoted for sand-lime brick in September:

Average Prices for September

Shipping Point	Plant Price	Delivered
Boston, Mass.	$12.00	$16.00
Dayton, Ohio	12.50	15.50
Detroit, Mich.	.....	15.50@16.00
Detroit, Mich.	13.00	15.00
Grand Rapids, Mich.	.....	14.00@15.00
Hartford, Conn.	14.00	17.00
Madison, Wis.	12.00@12.50	13.00@14.00
Milwaukee, Wis.	10.50	13.00
Minneapolis, Minn.	8.00	10.50
Mishawaka, Ind.	11.00	.....
Saginaw, Mich.	12.00	.....
Syracuse, N. Y.	18.00	20.00
Toronto, Canada	12.50	‡15.00
West Toronto, Ont.	.....	14.00

‡Less 5%, 10 days.

The following statistics are compiled from data received from 17 producers in the United States and Canada:

Statistics for August and September

	*August	†September
Production	16,838,000	13,389,000
Shipments (rail)	4,684,000	3,960,000
Shipments (truck)	11,615,000	10,216,000
Stocks	9,714,000	8,614,000
Unfilled orders	9,925,000	12,086,000

*Revised to include two plants not included in statistics published for this month. Eighteen plants reporting; incomplete, one plant not reporting stocks on hand, and eight not reporting unfilled orders.

†Seventeen plants reporting; incomplete, one plant not reporting production and stocks on hand, and five not reporting unfilled orders.

Notes from Producers

Wisconsin Brick Co., Madison, Wis., reports that it is supplying brick for the new West High School, Fenny office building and the East Side Theatre building.

Jackson Brick Co., Jackson, Mich., is supplying sand-lime brick for the new National Bank and Trust Co. building, Automotive Fan building, Consumers Ice Co. building and the County Road Commission buildings.

Reported Offer to Buy Idaho Cement Plant Turned Down

STOCKHOLDERS of the Idaho Portland Cement Co., at Inkom, Idaho, financed by Spokane people, when called together by the president of the company, E. J. Simons, on his return to Spokane recently, refused an offer of $240,000 increase on their original investment, Mr. Simons reported. The plant has a capitalization of $500,000 in preferred stock and $600,000 in common stock. Virtually all the preferred and a considerable amount of the common stock was sold in Spokane. The company was organized a year ago.

"One of the large cement companies in the southern Idaho-Utah field offered what was equivalent to an increase of 40% on the original investment of the stockholders," said Mr. Simons. "This would have given us $240,000 net gain on our investment for the year and made me personally some $200,000.

"I told our Spokane investors that so far as I was personally concerned, I would abide by their decision, and if they wanted to stick I would stay with them. There were between 40 and 50 stockholders at the meeting and to my great surprise not one, from the holder of a few shares to the largest stockholders in the group, would consider the offer. So I am going back to work again in a few days and will tell the prospective purchaser that we have nothing to sell. However, I aim to interview all of the stockholders before I go."

Mr. Simons reported that the Idaho Portland Cement Co., which entered the production stage a few months ago, is now operating its mill with three shifts and turning out between 1200 and 1500 bbl. a day. The sales, he said, are keeping pace with the output, shipments varying from 800 to 1600 bbl. a day. He reported the award of a contract to the McDonald Engineering Co. of Chicago, Ill., for the erection of concrete silos with a capacity for storing 75,000 bbl. of cement. The company, in addition, has already wood storage capacity for 20,000 bbl. of finished cement and a storage capacity for 100,000 bbl. in the clinker stage.—*Spokane* (Wash.) *Daily Times.*

A. F. Smith Becomes Vice-President in Four Monolith Companies

ACCORDING to recent announcement, Alfred F. Smith, formerly of Portland, Ore., has assumed his new duties as vice-president of the Monolith Portland Cement Co., Monolith Portland Midwest Co., Monolith Portland Gulf Co., and Monolith Corp.

Prior to becoming an official of the four concerns named, Mr. Smith was chairman of the executive committee of the Monolith Portland Cement Co. of California, having been elected to that position last April, following his purchase of a substantial interest in the companies. Mr. Smith, following his retirement from the Northwest and considerable travel in this country and abroad, established a home in Beverly Hills.

The new Monolith executive, while at Portland, was head of the Columbia River Shipbuilding Corp. and the Smith and Watson Iron Works, and also was heavily interested in the logging and paper mill machinery manufacturing business.—*Los Angeles* (Calif.) *Times.*

Southern Gravel Association Meets at Biloxi

MEMBERS of the Southern Sand and Gravel Association recently met at Hotel Buena Vista, Biloxi, Miss., at which time business transactions and plans for the coming national convention at Memphis, Tenn., were carried out. At a joint meeting with members of the Southern Builders Supply Association, papers were heard on financing properties, industrial development, federal trade practices and other topics.—*Jackson* (Miss.) *News.*

Chas. A. Porter Resigns from Lawrence Cement

CHARLES A. PORTER, for 41 years connected with the cement business, resigned as vice-president of the Lawrence Portland Cement Co., Thomaston, Me., and will retire from the office with the close of the present calendar year.—*Portland* (Me.) *Express.*

Danish Bulk-Cement Sea-Going Ship Launched

THE world's first sea-going cement-tank ship has been launched in Denmark by an engineering and shipbuilding company at Aalborg, according to information received by the U. S. Department of Commerce from Scandinavian sources. The ship is designed to carry loose cement in specially designed tanks, from which discharging will proceed through the medium of suction pumps. Both loading and discharging operations will be extremely rapid. The seven tanks with which the vessel will be fitted will hold a total of 1400 tons of cement. The propelling machinery will consist of two Fairbanks-Morse Diesel motors developing a total of 800 h.p. and a speed of 11 knots per hr.

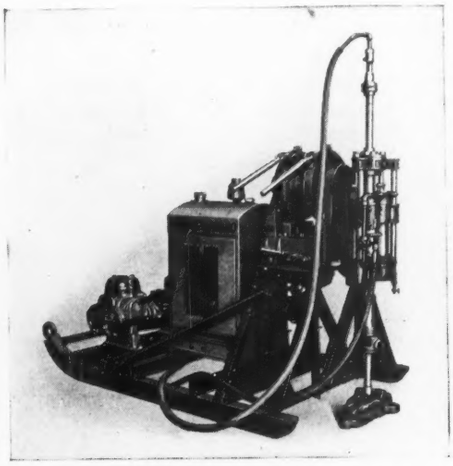
Correction

THE Winnipeg Supply and Fuel Co., Winnipeg, Man., D. C. Henderson, vice-president, states that the news item in ROCK PRODUCTS, September 28, p. 107, to the effect that this company had made a contract with Lime and Hydrate Plants, Inc., York, Penn., for a 100-ton gas-fired, lime plant at Moosetown, Man., is not correct.

New Machinery and Equipment

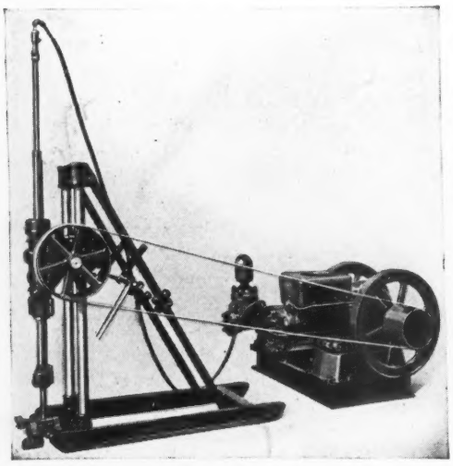
Three New Diamond Core Drills

THREE new models of diamond core drills, types 20 and 40 for universal prospecting to depths not exceeding 1000- to 1200-ft., type "Bravo-300 for taking cores up to 300 ft. in depth, are announced by the Sullivan Machinery Co., Chicago, Ill. The type 20 has a capacity of 1000 ft. equipped with "A" (1⅝ in.) core fittings, or 1150 ft. if size "E" (1 15/16-in.) core fittings are employed. It can be equipped with either hydraulic



Diamond core drill, capacity 1150 ft. with 15/16-in. core

swivel-head or screw feed swivel head, as required by the conditions of the ground where the machine is to be used. With either of these swivel heads the "Type 20" will drill at any angle required. The drill is completely self contained on a skid steel mounting or base together with its gasoline engine power plant and chain driven circulating pump. The machine may be mounted on a motor truck or wagon.



Diamond drill to take cores up to 300 ft. in depth

A hoist of entirely new design has been mounted with this rig and two speeds are provided for both hoisting and rotating the drill rods, the manufacturers say. A steam or compressed air engine or electric motor may be obtained for using this rig underground if desired.

The type 40 is driven by direct connected gasoline engine, is mounted complete with power plant and pump and hoist, on a substantial steel frame, carried on a heavy steel wheel truck for convenience, in moving from place to place. It will drill to a depth of 1200 ft. with size "N" fittings, making a 3-in. hole and removing a 2-in. core, and to a depth of 2200 ft. with size "A" fittings, removing a core 1⅝ in. in dia.

A new type of hoist has been built for this machine; it has four hoisting speeds and four rotating speeds. The engine is a Buda 29-hp. 4-cyl. 4-cycle unit providing ample power for drilling, hoisting and pumping service. A 3½x5-in. duplex pump is placed on the base between the engine and hoisting drum and is driven from the front end of the engine through a two-speed transmission.

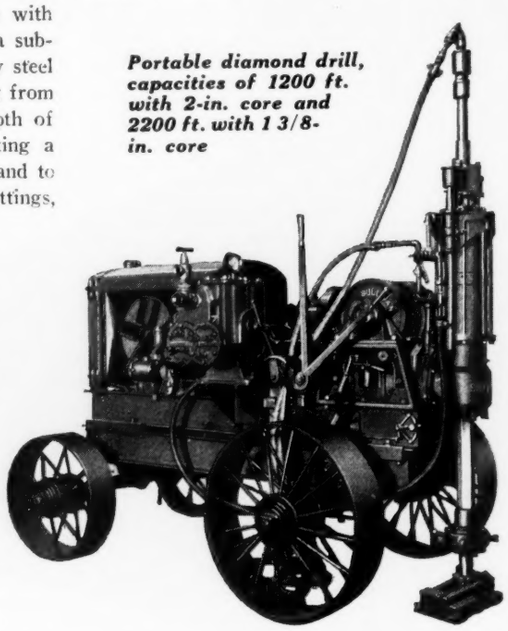
The "Bravo-300," of new design, gasoline engine driven type, is for taking cores up to 300 ft. in depth. It is equipped with screw feed swivel head of a new pattern which gives increased strength and reduced wear. Two sets of feed gears are furnished with the machine, and the feed screw accommodates 24-in. runs of the drill rod. The end of the drive shaft opposite the belt pulley which drives the drill is equipped with a cathead driven by gearing. This cathead provides ample capacity for hoisting 300 ft. of size "E" (1 15/16-in.) core rods.

A 6 hp. water-cooled gasoline engine is supplied, together with a pump, mounted on the engine frame. If desired, an electric motor may be substituted for the gasoline engine, together with a separate motor driven pump.

Temperature Control Instruments

THREE new catalogs illustrating and describing recent developments in temperature control instruments have been recently issued by Leeds and Northrup Co., Philadelphia, Penn. Bulletin No. 870 deals with potentiometer pyrometers for temperature control in the petroleum industry, though it also lists a use in the refining of fuller's earth; No. 87 gives some important facts about construction types and uses of potentiometer pyrometers, outlining the wide variety of these instruments available for industrial temperature measurement and the service to which each of these is adapted. The applications, types and uses of optical pyrometers are illustrated and described in Bulletin No. 86.

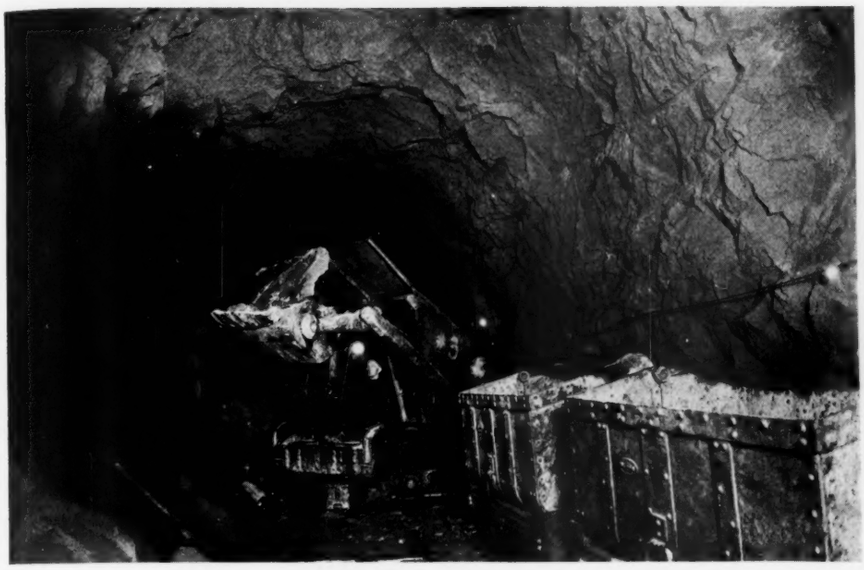
Portable diamond drill, capacities of 1200 ft. with 2-in. core and 2200 ft. with 1 3/8-in. core



The company has also recently brought out "Notes on the Kelvin Bridge," in which is explained the principles of the Kelvin bridge method of measuring low resistances, followed by a discussion of the several types of this bridge available for different applications of the method. The purpose of this booklet is to give information which will be of assistance in the operation of the Kelvin bridge.

Small Shovel for Underground Quarry Work

NOT ALL the rock products operations are of the open-pit type; gypsum mines are as a rule underground and in some instances, limestone is recovered from subsurface mines. The Thew Type S, electric mining shovel has been designed specifically for work in restricted quarters in underground mines, being quite low and having a small clearance. It is crawler mounted, and equipped with a ½ cu. yd. dipper of special design. Three electric motors are provided for hoisting and lowering; for crowding and



Small eletric shovel for underground quarrying

retracting or traveling; for swinging in a complete circle. Automatic electric limit switches are provided on all operations to insure safety. Within the limits of an 18-ft. tunnel the Type S can be easily maneuvered for traveling and can make a full circle swing, the manufacturers say.

The machine weighs approximately 13 tons and has a crowding force of approximately 12 tons.

The shovel, as illustrated here, is working at a subway construction job in New York City and digging a hard gneiss.

Material reclaimed by the loader is thrown against a deflector which breaks up the discharge and tends to spread the material before it reaches the primary vibrating screen. The secondary vibrating screen is a Leahy 4 ft. by 5 ft.; both screens are vibrated from the bucket loader's power unit. Several different sizes of wire cloth are used with the secondary screen as desired. Materials sized and separated are chuted off as shown into trucks or to the ground.

The unit is mounted as crawler treads, moving under its own power.

Portable Pumping Unit Handles Dirt and Trash-Laden Waters

A COMPACT portable pumping unit, capable of handling dirt and trash-laden water, sludges, etc., is announced by Fairbanks, Morse and Co., Chicago, Ill. The new unit has a C. H. and E. drive and is made available for several types of mountings. It has a simple priming device.

Anything that will enter the suction nozzle through a right angle bend the impeller will pass, the manufacturers say, the pump being designed to handle solid spheres as large in diameter as the pipe size next smaller than the suction connections.

New Screening Unit

A COMBINATION of Leahy Deister screen and Barber-Greene Model 42 bucket loader, with design modifications in both pieces of equipment to meet the purpose, has been recently brought out by the Barber-Greene Co., Aurora, Ill. The chief interest this piece of equipment offers the established rock products industry is its possible use for rescreening of stockpiles, something which producers often have to do to get material of unusual specification sizes.

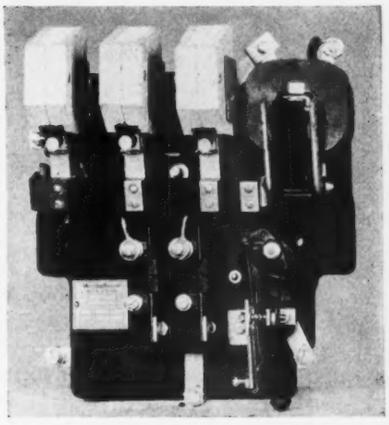
"Non-Glare" Glass for New Instruments

THE USE of a special glass which prevents glare is one of the features of new instruments for switchboards introduced by the General Electric Co. The special glass, in combination with anti-parallax scale and pointer, facilitates reading regardless of the angle from which the instrument is viewed.

The new line of instruments is uniform in size and appearance for both a.c. (Type AD) and for the d.c. (Type DD) ammeters, voltmeters, wattmeters, reactive volt-ampere meters, power-factor meters, and frequency meters. They are listed in standard commercial frequencies, but special ratings and scale markings can be furnished. Both a.c. and d.c. instruments have electromagnetic damping.

Linestarter Without a Cabinet

IN SOME machinery applications it is desirable to mount the starter within the machine and in this case the cabinet is not required. For such service the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., supplies the unit of the improved linestarter without a cabinet. Like the other linestarters, this starter is also equipped with the deion arc quencher and the thermal overload relay. These new and improved features are said to add to the safety in operation of the linestarter. Westinghouse linestarters without cabinets may be obtained in three sizes covering a range up to 50 hp.

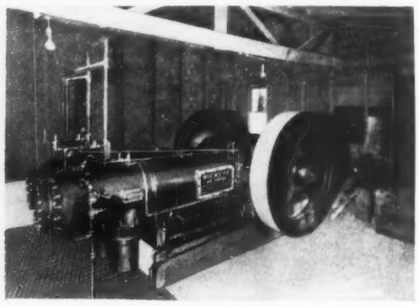


Linestarter without a cabinet

Screening unit suitable for reworking stockpiles

Diesel Operating Costs in a Stone Crushing Plant

THE LONG Stone Co., operating a quarry and crushing plant at Lima, Ohio, recently installed a 190-hp. Buckeye Diesel engine to supply power for operating the equipment; this replaced an 80-hp. steam engine. Equipment to be driven included: A No. 5 and No. 3 Gates gyratory crusher, No. 3 McCully gyratory, 3-ft. Symons cone crusher, Allis-Chalmers elevator and rotary screen, 5-in. and 6-in. water pumps. Water



The 180-hp. Diesel at the Long Stone Co.'s plant

was pumped for two hours each day, entailing a 60-hp. load for the pumps.

In 1927, the last year of steam operation, the costs were:

Fuel (coal)	$2440
Labor (engineer at $6 per day and hauling coal)	1418
Total	$3858

On a tonnage basis, the power costs were calculated to be $0.081 per ton.

At the time the Diesel engine was installed, the 36-in. Symons crusher was added; this increased the load by 75 hp. over the former load. The costs of the Diesel-operated plant became:

Fuel (oil at 8c per gal., delivered)	$ 873.46
Lubricating oil at 51c per gal, delivered	84.00
Repairs	15.25
Engineer at $5 per day	770.25
Total	$1742.96

Based on the tonnage produced, power costs were found to be $0.049 per ton, or about 50% decrease from the steam-operated costs. This was materially decreased during this season, for the company decided to do away with the services of the engineer, on finding that it was only necessary to make a routine hourly check on water circulation, etc., which could easily be done by one of the regular employes.

The above data on the Long operation were furnished by the Buckeye Machine Co., Lima, Ohio, through the courtesy of the William J. Grover Co., Lima.

Canada Cement Co. Enjoying Good Business

AN order for 200,000 bbl. of cement for Welland canal construction has been received from the Canadian Dominion Government by the Canada Cement Co., Ltd. It is understood that this order may be followed up with others later in the year, depending upon the progress made on canal construction.

With this business and the increasing sales reported from the West, Canada Cement Co. is apparently off to another good year. While no information is forthcoming as to the volume of Eastern sales, the amount of new building undertaken would indicate no let down in consumption of cement.

Just recently the company has acquired three properties at Saint John, one of them being the old Portland mills property. It is believed the company intends to establish a large trans-shipment depot at that point.

Since the Holt-Gundy banking interests took over the Canada Cement Co. large sums have been expended in improving the property. Important alterations have been made at the Winnipeg, Hull and other plants with a view to further economies and increasing production.

Most of the work along this line has been completed or well under way and the results are said to be up to expectations.

Quarry and crushing plant, Long Stone Co., Lima, Ohio

Arkansas Cement Plant Formally Opened

THE ARKANSAS PORTLAND CEMENT CO., Okay, Howard county, Arkansas, was formally opened October 2.

A special train was run by the company from Little Rock to Okay over the Missouri Pacific Lines. It consisted of several coaches, a dining car and official cars of officers of the railroad company. Many of Little Rock's business leaders and government heads as well as officials of the railroad were guests of the cement company on the train and at the plant, where a special luncheon was served.

Tehachipa, Calif., Lime Plant Discontinued

IT IS reported that the Union Lime Co., Los Angeles, Calif., has permanently abandoned its lime operation at Tehachipa, Calif., because of the high cost of quarrying limestone there. This plant has been supplying lime to southern California for over 40 years, and Mr. Wyman, who founded the business, is one of the pioneer lime manufacturers on the Pacific coast.

Foremen's Club Visits Cement Mill at Osborn

TWO HUNDRED and six members of the Foremen's Club held their first meeting of the winter season at the Southwestern Portland Cement Co. plant at Osborn, Ohio, recently, and heard talks by several of the officials of that plant following a chicken dinner served in the company offices.

Many interesting facts concerning the cement industry were told the guests by officials of the Southwestern company. The concern, which employs 350 men uses 4,000,000 kilowatt hours of electricity each month, all of which is manufactured by its own generators. Waste heat from the cement kilns is used to furnish steam to run the generators, the men were told by William McKinsey, chemical engineer, one of the speakers.—*Springfield* (Ohio) *News.*

Trade Commission Reviews Supervision of Business Conduct

RESOLUTIONS adopted at 10 trade practice conferences await action by the Federal Trade Commission, while nine conferences authorized have not yet been held, it has just been announced by the Federal Trade Commission. Sixty-eight conferences have been held since the procedure was instituted in 1919, it was stated. Among the conferences authorized and awaiting final action of the commission is the one concerned with lime. (See ROCK PRODUCTS, June 22, 1929.)

Marquette Appoints Charles Peyton General Sales Manager

CHARLES PEYTON has been appointed general sales manager of the Marquette Cement Manufacturing Co., Chicago, succeeding Paul R. Price, resigned. The appointment was effective September 17, 1929.

Lime Meeting at York

LIME manufacturers in York, Penn., and within a radius of 50 miles of that city met recently at the Hotel Yorktowne for the purpose of developing a greater co-operation among manufacturers of lime and having the users of lime receive accurate and reliable information pertaining to its various uses. The meeting was in charge of Norman G. Hough, president of the National Lime Association, Washington, D. C.

Lime in the construction and chemical fields came in for a full share of consideration.—*York* (Penn.) *Dispatch.*

Beg Your Pardon!

OUR long-time and valued friend, Eric Ryberg, general manager of the Utah Sand and Gravel Products Corp., Salt Lake City, Utah, writes us that it was his plant illustrated and referred to on p. 65 of Walter B. Lenhart's article on "Rock Products Developments in a Seldom Explored Territory" (ROCK PRODUCTS, September 14), as the "Atlas Sand and Gravel Co." plant. That's one we'll have to blame on Editor Lenhart's crabbed, almost ineligible handwriting, although we should have recognized the plant from the picture.

We are sorry we slipped up on this because Mr. Ryberg, among many other evidences of friendship, has done quite a lot to circulate the term "Rock Products." We believe he was one of the first to advertise his materials under that heading, although many now do so. There are now numerous "Rock Products" companies and at least one "Rock Products" association in various parts of the country.

Incidentally, Mr. Ryberg has a very unusual and attractive letterhead, which we are reproducing here as well as we can in one color. In the actual letterhead the shield with "Rock Products" on it is in bright red, and the picture of the plant in a faint orange red.

Copiah Gravel Co. Under New Management

THE sale of the Copiah Gravel Co., Crystal Springs, Miss., to an Arkansas capitalist who held first mortgage on the property is announced in the *Jackson* (Miss.) *Ledger*. The company, advertised to be sold to satisfy creditors, brought $21,000, this amount being the best bid made on it.

The Copiah company, located about two miles northeast of Crystal Springs, acquired a splendid acreage in gravel here, consisting of about 300 acres. The company several years ago installed improved machinery for working the fine gravel deposits, and built a spur of railroad connecting the land with the Illinois Central railroad for convenience of shipments. The output from the gravel pits has run into many carloads daily.

It will now be under new management, and the plant will likely continue to make carload shipments of both pit and washed gravel.

Asphalt Association 1929 Convention at West Baden

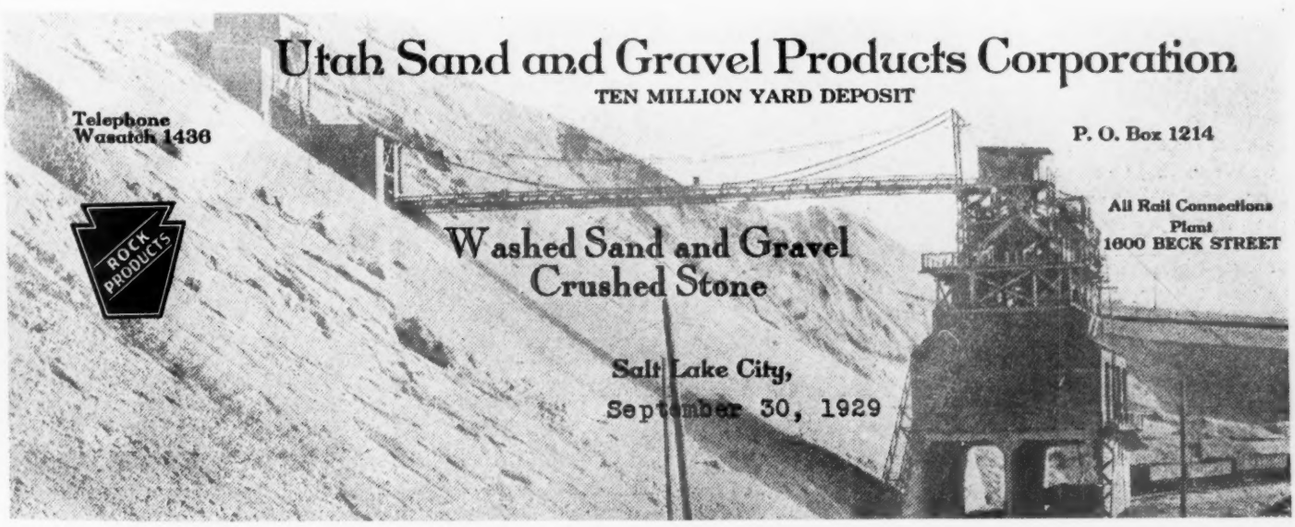
THE eighth annual asphalt paving conference, under the auspices of the Asphalt Association, will be held at West Baden Springs Hotel, West Baden, Ind., on October 28, 29, 30, 31 and November 1, 1929.

Mineral Aggregate Co-operative Selling Organization Sues Buyer

THE Mineral Aggregate Cooperative Association of Milwaukee county, Milwaukee, Wis., it will be recalled by readers of ROCK PRODUCTS (August 31, 1929, issue, p. 97) recently sued one of its own members for breach of contract in selling material direct to a paving contractor. The association is chartered under a peculiar law in Wisconsin designed primarily to permit co-operative buying and selling organizations in agricultural lines. The state supreme court subsequently ruled the law and the privileges it confers cannot be confined to the agricultural industry. Hence building material producers, dealers and others have taken advantage of the law to organize cooperative selling agencies which contract with their members to sell their entire output and prorate each plant's production accordingly.

According to Milwaukee newspapers, the Mineral Aggregate Association is now suing the purchaser of the materials that the rebel member is accused of selling. The plaintiff alleges that the defendant broke his contract to buy all his sand, gravel and crushed stone requirements only through the association. The case of the association against its former producer member, we believe, is still in the courts. The producer defendant alleged that his contract with the association was void because it was a combination in restraint of trade and contrary to public policy.

The case is very interesting and important to all producers of basic commodities because it is probably the first attempt so far made to legalize pools and division of business in an over-produced industry. While at present the Wisconsin law permitting such an association is unique, if it is successful we may see other states follow suit. There is every evidence that these cases will be carried through to the highest courts.



Unusual and attractive letterhead of the Utah Sand and Gravel Products Corp., Salt Lake City, Utah

Bulk Cement Carrier to Ply Between Norfolk and Washington, D. C.

THE FIRST all-steel self-unloading barge for transporting bulk cement in Chesapeake Bay waters was launched recently at the plant of the New York Shipbuilding Co. at Camden, N. J. This barge was built for the Lone Star Cement Co. Virginia, Inc., a subsidiary of the International Cement Corp., and will be used to transport bulk cement from the company's South Norfolk, Va., mill to its Washington, D. C., warehouse. Mrs. Dwight Morgan, wife of the vice-president and manager of the Lone Star Cement Co. Virginia, Inc., christened the barge the *Lone Star No. 1.* The barge is 163 ft. in length and has a beam of 37 ft. 4 in., with total capacity of 5600 bbl. of cement.

The "Lone Star No. 1," new self-unloading, bulk cement carrier to ply between South Norfolk, Va., and Washington, D. C.

In explaining the purpose of the new barge, Dwight Morgan, vice-president and manager of the Lone Star Cement Co. Virginia, Inc., said:

"This barge is part of the equipment which makes it possible for us to extend farther afield than would normally be the case, the market for a product made in Norfolk.

"By making use of the low-cost transportation of the natural waterways of the country we are leaving no stone unturned in our effort to market our output against the invasion of foreign cement."

Large Quarry Developments Expected Near Thorold, Ont.

THE options on approximately 158 acres of land comprising the farms owned by Brown brothers, H. B. Marcille, and the quarries belonging to the Battle estate, located in what is locally known as "Cartmell's mountain," just beyond the northeastern boundaries of Thorold, have been taken up, according to report. The land contains large areas of stone which is said to be peculiarly suited to the uses of sulphite mills, the rayon industry and to various kinds of smelting.

The negotiations were conducted by John Shriner of Thorold, who was acting for Montreal interests headed by Angus W. Robertson, formerly of the contracting firm of Doheny, Quinlan and Robertson, Welland ship canal contractors, in the initial stages of that great development.

It is understood that the acquisition of this land is the forerunner of big developments on the mountainside above the new ship canal, and that the opening of large stone quarries and one of the biggest rock crushing plants in Canada by the Montreal people is merely a beginning with other ambitious projects already in the air.

Arrow Company Proposes to Straighten Scioto River

CREATION of a new city lake opposite the municipal golf course along Dublin road is incorporated in a proposal of the Arrow Sand and Gravel Co., Columbus, Ohio, to straighten the Scioto river by cutting a new channel along the city property at this point.

The proposal, which has the support of the committee on parks and playgrounds of the Chamber of Commerce, will be placed before the city council.

After the Arrow company has removed its materials from the plot of ground between the old river bed and the proposed channel, it would dedicate that plot to the city as a site for a lake.

Waste materials from the gravel company's operations will be utilized to fill in the land owned by the city on the south side of Dublin road, opposite the municipal golf course, if the plan is adopted.

Little or no cost to the city would attend the change, sponsors of the plan indicated.—*Columbus* (Ohio) *Dispatch.*

Texas Cement Shipments Up in August

DURING August, cement plants in Texas were operating at about the same rate as they were in July. Shipments, however, were considerably larger so that stocks were materially reduced. This was regarded as an encouraging feature because stocks are already large and, normally, the seasonal gain begins in August. During the month, 707,000 bbl. were turned out by Texas mills against 701,000 bbl. in July and 519,000 bbl. in August last year. Shipments increased from 666,000 bbl. in July to 786,000 bbl. in August, the highest on record. Stocks on August 30 amounted to 466,000 bbl., or a decline of 14½% from the month previous.

The demand fell off somewhat and prices were reduced 10 cents a bbl. on August 22. The basic price on that date was $2.15 per bbl. in Dallas and $2.25 in Houston.

J. R. Fairman Now in Charge of Eastern Offices, P. C. A.

THE Portland Cement Association announces the appointment of James R. Fairman to be manager, eastern offices, with headquarters at 347 Madison ave., New York City, succeeding B. H. Wait, resigned. Mr. Fairman is a graduate of the University of Missouri, and was engaged in bridge designing and general engineering work in Kansas City and vicinity for several years.

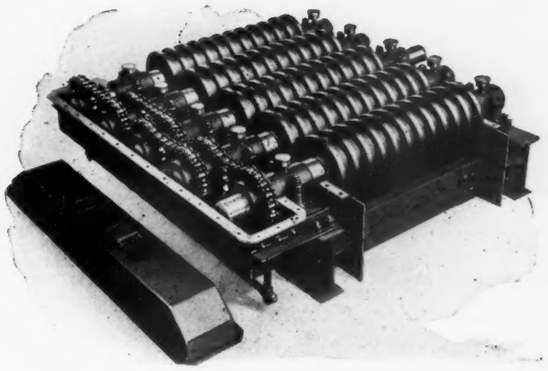
Mr. Fairman joined the field staff of the association at Kansas City in 1919 and was appointed district engineer in charge of the Birmingham, Ala., office in 1923. Since December 1, 1925, Mr. Fairman has been manager, southeastern offices, Atlanta, Ga., and will continue to supervise association activities in the southeast.

Revise New York State Lien Law

LIENS filed for the purpose of insuring payment for labor and materials supplied to building construction operations through the state after September 30 will operate under the terms and conditions set forth in changes made to the New York mechanics lien law, enacted by the last legislature at the request of the Association for the Revision of the New York State Lien Law, writes Allen E. Beals in the current *Dow Service Daily Building Reports.*

These changes and amendments admittedly fail to give all the credit relief building material, financing and contractors feel that they must have before proper confidence can be workably mutual between the financier, owner, builder, contractor and material men. The new law says that all liens shall be on a parity except liens of laborers shall be prior to liens of material-men and contractors.

Multi-Roll Sizers

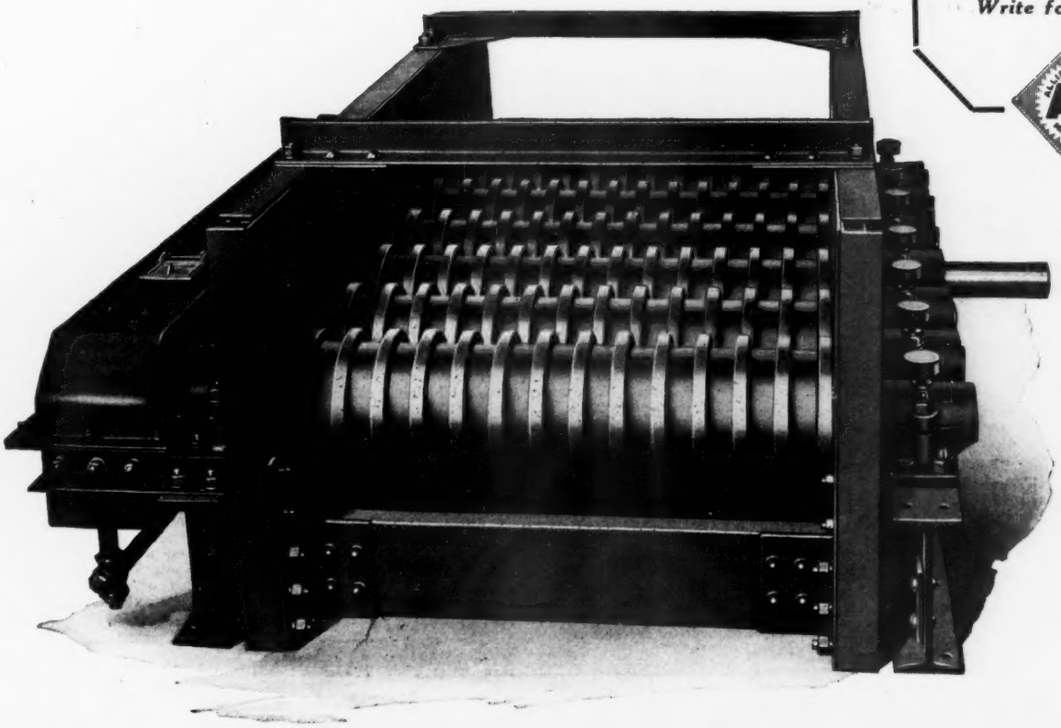


Multi-Roll Sizers for scalping and sizing, are built for screening many commercial sizes of materials. They are of heavy construction with structural steel frames. The driving mechanism is enclosed in a dust and oil tight housing. The shafts are mounted in large bearings with grease cup lubrication and are driven from a central shaft through roller chains. The chains operate in a bath of oil. All parts are readily accessible and easily removable. The Multi-Rolls operate at differential speeds giving a rapid segregation of the materials and consequent high capacity with minimum power and maintenance. Multi-Roll Sizers are built in a wide range of sizes for capacities from 50 to 800 tons per hour.

A-C SERVICE

Allis-Chalmers products include complete equipment for crushing, screening and cement plants. Our Engineers are at your service to design and install a complete highly efficient plant, to extend your present plant or to help solve your crushing problems. The fact that motors, pumps, and power plant equipment are also built by Allis-Chalmers and adapted to this particular service affords the customer the unusual opportunity of obtaining all his required equipment under one contract and from one responsible manufacturer.

Write for Bulletins



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Standard Quarries, Ltd., Toronto, Can., $40,000.

Neo Tile Co., Ltd., Montreal, Can., 400 shares, no par value.

National Gravel and Fuel, Ltd., Windsor, Ont., $100,000.

Toronto Ready Mix Concrete, Ltd., Toronto, Can., $200,000.

Interlake Quarries, Ltd., Toronto, Ont., Can., $1,000,000.

Gibson Concrete Corp., Buffalo, N. Y., $10,000. F. D. Russell, Buffalo.

Duntile By-Products Mfg. Co., Wilmington, Del., $50,000. To deal in cement, stone, sand and gravel.

Columbia Marble Co., Knoxville, Tenn., $300,000. B. F. Coggins, C. B. Comolli and W. S. Burton.

Chappus Gravel Co., Ltd., Windsor, Ont., Can., $600,000. A. Chappus, M. Chappus and others.

Limestone Dust Corp., Pocahontas, Va., $50,000. C. Henry Harman, president, Tazewell, Va.

Canadian Rock Products, Ltd., Montreal, Can., 100,000 shares common, no par value, and 5000 shares preferred, par value $100 each.

Tennessee River Sand and Gravel Co., Paducah, Ky., $50,000. F. W. Olcott, 431 S. Third St., Paducah, Ky.

Valley Gravel Co., Benton Harbor, Mich., $35,000. Harry Hutson, I. C. Slooter, Fred Glupker and Dwight M. Ruth.

Anchor Concrete Products Corp., San Antonio, Tex., $30,000. Fred Christilles, William Levin and Stella Spahn.

Sayre Duntile Mfg. Co., Sayre, Okla., $15,000. F. M. Gregory of Sayre and G. H. Bryant, Channing, Tex.

Concrete Products, Ltd., Regina, Sask., Can., 500 shares preferred and 35,000 shares common no par value stock.

Smith Sand and Gravel Co., Inc., Orlando, Fla., 2000 shares, par value $5. J. Wesley Smith, I. H. Smith and W. W. Lotridge.

Texas Quarries, Inc., Austin, Tex., subsidiary of Indiana Limestone Co. To operate limestone quarries.

Garland Block and Sand Co., Youngstown, Ohio, increased common stock from $50,000 to $100,000 in 1000 shares of $100 par value. E. A. Brumm, president, and M. Obendorfer, secretary.

Oak Hill Sand and Gravel Co., Needham, Mass., $10,000; 100 shares, $100 each. John Pearson, president; Ralph A. Mention, Dorchester, Mass., treasurer, and Perley W. Smith.

Buffalo Colloidal Phosphate Sales Co., Buffalo, N. Y., 400 shares common stock, no par value. Frederic R. Twelvetrees, Ira W. Smith, 15 Tennyson Ave., Buffalo, and Alan K. Sawyer, Arcade, N. Y.

Quarries

Waldo Forster, San Antonio, Tex. (220 Montrose Ave.), has uncovered a fine granite deposit here which he plans to develop soon.

Kelley Island Lime and Transport Co., Kelley Island, Ohio, recently shipped 4960 tons of limestone flux to the Bethlehem Steel Mills, Erie, Penn.

Florida Basic Rock Co., Marianna, Fla., recently received an order from the Florida state road department for 15,000 tons of material.

Owen Sound Quarries, Ltd., Owen Sound, Ont., has recently acquired the well-known quarry formerly owned and operated by the Oliver Rogers Co., Ltd. This quarry, located in the eastern section of the city, covers 81 acres and has been developed for production of dimension stone as well as crushed stone for concrete aggregate and road material.

Sand and Gravel

Cuero, Tex. Southern Pacific railway is working several gravel pits in this vicinity. Between 40 and 50 carloads of gravel are loaded per day, according to A. D. Mimms, superintendent.

Garland Block and Sand Co., Youngstown, Ohio, is operating a new sand plant at Kent, Ohio, with a daily capacity of 500 tons of washed sand and gravel. The material produced at the plant is shipped to the main plant at Youngstown for making cement blocks and for retailing.

Pacific Sand and Gravel Co., Portage, Wis., has installed a new crane at a cost of $13,000, the third crane to be placed in operation in the company's pits. According to J. N. Thouvenell, president of the company, the additional equipment was necessary to increase production, the company being 500 carloads of sand behind in its orders.

Gilley Bros., New Westminster, B. C., who purchased the Fresh Water Sand and Gravel Co., Ltd., of New Westminster a year ago, now has plans under way for the development of that company. The property known as Mary's Hill, containing a large sand and gravel deposit, has been purchased and a modern sand and gravel plant is planned.

Valley Gravel Co., Benton Harbor, Mich., incorporation notice of which appears in this issue, is operating a plant near Pipestone road and Nickerson on the St. Joseph river, where the company owns 10 acres of land. The plant is equipped with dredging, washing and screening machinery and it is planned to install additional equipment, including a stone crusher, later on.

Beder Wood Sons, Moline, Ill., has acquired a 200-acre tract of land at Camanche, Iowa, from Wallace Lum at a reported price of $100 per acre and will develop extensive gravel and sand pits on the site. The tract reaches from Camanche almost to the Clinton city limits and from the river front to the railroad tracks. The firm expects to build several residences on the site for occupancy of its employes and will expend $10,000 in plant and equipment on the tract. Construction of a new highway through the Wood pits in Illinois has interrupted work there and necessitated finding a new site for fulfillment of its contracts.

Cement

Arkansas Portland Cement Co., Okay, Ark., according to reports, is considering installing additional kilns and other equipment to double present capacity of plant.

Wabash Portland Cement Co., Detroit, Mich., is planning a one-story addition to its Osborn, Ohio, plant, 60x340 ft., to house kilns and turbine room. The building will cost about $100,000 with equipment.

Spring Valley, Minn. Cement plant rumors have caused considerable excitement in the three communities of Leroy, Osage and Floyd. Crews of men have been drilling in each community and the people are beginning to wonder whether the drillers are trying to find out if these places are suitable for cement plants or some other limestone industry.

British Columbia Cement Co., Ltd., Victoria, B. C., has completed a large concrete wharf, 200 ft. square, on the north end of Texandra Island, at a cost of about $25,000. Cement piling reinforced with iron was specially made for it at the company's Bamberton plant. A large conveyor, which will load 700 tons of lime rock an hour, is to be installed.

Florida Portland Cement Co. directors recently met at Tampa, Fla., to consider the affairs of the big plant at Hooker's Point, Fla. S. W. Storey, Chicago, vice-president of the company, presided over the meeting in the absence of John L. Senior, president, who is in Europe. Among the others in attendance were Frank E. Dodge, chief engineer of the Cowham Engineering Co. of Chicago, with which the Tampa company is affiliated; J. P. Hoskins, president of the First National Bank of Chattanooga; Francis P. Butler, president of Butler, Senior and Co., Chicago, and Howard Miller, secretary-treasurer of the company.

Lime

Claremont Marlime Co., Claremont, Va., has acquired the Guilford Marlime Co., and is making considerable improvements in the plant. Karl Stein is manager.

Calera Lime Works, Calera, Ala., has been taken over, effective July 1, 1929, by the Standard Lime Co., Birmingham, Ala. Harry Burgess, president and general manager.

Gypsum

Standard Gypsum Co., San Francisco, Calif., has opened a distributing warehouse in Vancouver, B. C., in charge of F. R. Ritchie.

Agricultural Limestone

Edgewood, Iowa—Business men here are sponsoring a liming demonstration. A number of farmers have already used agricultural limestone with good success.

Janesville, Wis.—According to H. C. Hemmingway, Rock County Farm Bureau secretary, the bureau's crusher is at work again here to meet the fall demand for limestone for soil improvement.

Le Grand Limestone Co., Le Grand, Ia., is supplying agricultural limestone for the first limestone train to be run over the Chicago Great-Western railroad, which will unload 11 cars of limestone, each carrying 45 tons of agstone, along the right-of-way between Luray and Melbourne, Iowa.

Edwardsville, Ill.—Farm Adviser T. W. May has completed a series of soil tests throughout the county, and from which he has secured some figures showing the needs of the soil. Most of the land tested shows a need of limestone, while the need for phosphate is smaller.

Lane County, Ore.—Nine carloads of agricultural limestone have been ordered from the state lime plant by farmers in various sections of the county. The county will utilize approximately 400 tons of limestone this year, as compared with last year's record of 200 tons. The cost will be $6.60 per ton.

Cement Products

Amarillo Duntile Manufacturing Co., Amarillo, Tex., is planning the removal of its plant to Sayre in order to be nearer the source of sand used as aggregate.

Mt. Carmel, Penn. The cement block plant of Ignatius Patricosky was damaged to the extent of $12,000 by a fire believed to have been started by some boys who broke into the plant. A drum of oil exploded, causing heavy damage to the plant.

American Concrete Pipe Co., Tacoma, Wash., submitted the lowest basic bid to the board of public works for the construction of the Lake Youngs aqueduct. The company's bid was $345,470.50, which bid was $69,945.50 less than that of the second lowest bidder.

Granite Concrete Stone Co., Milwaukee, Wis., has purchased a site in New Butler, just outside of Milwaukee, on which a new and modern cement products plant, 135 ft. by 50 ft., will be erected. The new plant, replacing the older operation in Milwaukee, will be similar in management and design to the latter.

Cement Products Co., Davenport, Iowa, has appointed C. V. Easterwood, formerly of the General Cement Products Co., Pittsburgh, as manager of the cast stone branch of the company's business. Rapidly increasing demand for its special white face cast stone, which has been gradually introduced in this section of the country, necessitated employment of an expert in that field to handle the highly technical work in production of quality material. The company has had several important orders in this territory during recent weeks and although its spring and summer business kept the plant at capacity production, unfilled orders give promise of continuation of a high output during the forthcoming months.

Miscellaneous Rock Products

Southern Phosphate Corp. is now a part of the Davison Chemical Co., Pittsburgh, Penn.

Calrock Asphalt Co., Santa Cruz, Calif., recently reorganized, will start operations soon at its rock asphalt deposits.

J. G. Gilchrist, Medina, Tex., is contemplating the development of a potash mine fourteen miles west of Medina, Texas.

F. C. Worth, 53 W. Jackson Blvd., Chicago, Ill., has acquired a tract in North Carolina con-

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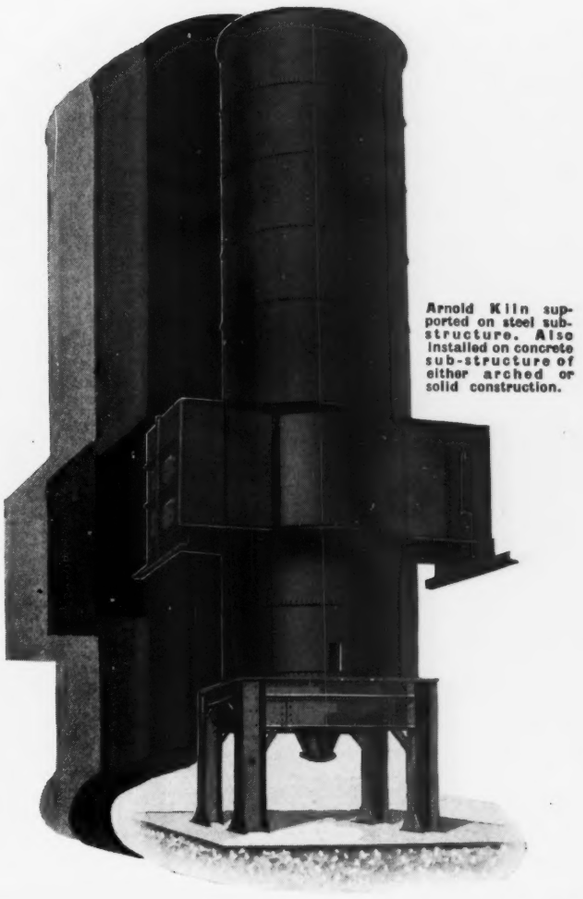

Arnold Kiln supported on steel substructure. Also installed on concrete sub-structure of either arched or solid construction.

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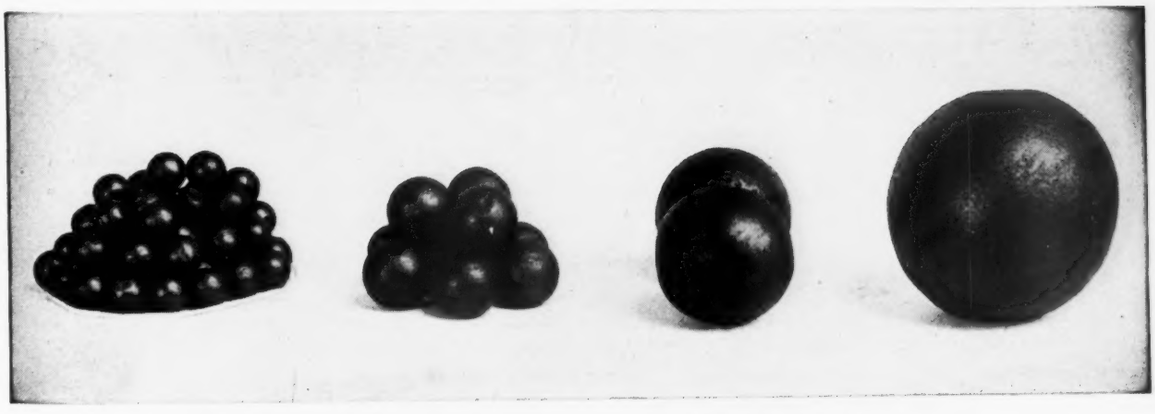

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taining asbestos and fibrous enstatite, and plans erecting a processing plant soon.

Northwestern Iron and Metal Co. has acquired the Potash Reduction Co.'s plant at Hoffland, Neb., one of the oldest and largest in the potash district. The company operates several other potash plants.

Idaho American Phosphate Co., Nampa, Idaho, has started construction work on its new warehouse on First street south, according to H. D. Jackson, president of the company. The one-story building will cost $2500, and will be used for the storage of phosphate shipped from Paris, Idaho.

Agricultural Potassium-Phosphate Co. of California, Ltd., has leased the Trona plant buildings in San Pedro, Calif., and will install machinery and equipment costing approximately $110,000 to manufacture phosphate and other commercial inorganic fertilizers. Initial equipment will be provided for an output of 40,000 tons per year.

MacMyrl Talc Mining and Milling Co. are going ahead rapidly in the development of talc deposits in the upper Skagit Valley, Washington, and the company expects to be shipping commercial talc in large quantities in the near future. According to Wm. Madden and Wm. Pooler, who are in charge of this development work for the company, there is a large quantity of talc in the mine, ranging from the highest grade of white talc to the cheaper grades.

Obituaries

John W. Brooks, a foreman at the Western Indiana Gravel Co., Lafayette, Ind., died September 30 at the age of 68.

Charles James Bell, Washington financier and banker, and a director of the Columbia Sand and Gravel Co., died October 1 at the age of 71.

Benjamin Jelinek, 40, former secretary of the Concrete Products Association, died at his home in Milwaukee, Wis., after a brief illness.

Personals

J. H. Waters has resigned as vice-president of the New York Air Brake Co. to become president of the Marion Steam Shovel Co., Marion, Ohio.

Arthur B. Shelby, general manager of the Calaveras Cement Co., San Francisco, Calif., was elected vice-president at a recent meeting of the board of directors of the company.

Wylie Hemphill, who recently resigned as vice-president and sales manager of the Pacific Coast Cement Co., Seattle, Wash., to become vice-president of the National Bank of Commerce, was given an honorary dinner by the officers of the cement company.

Frank J. Barrett, Washington district manager of the Portland Cement Association, addressed the county commissioners and county engineers of Washington during their recent annual convention held at Walla Walla, Wash. "Modern Practices in Concrete Road Construction" was the subject of Mr. Barrett's talk.

Darwin Meisnest of the Pacific Coast Cement Co., Seattle, Wash., was also a speaker at the meeting of county commissioners and county engineers at Walla Walla, Wash. Mr. Meisnest discussed "The Trend of the Future in Terms of Concrete Facts."

Henry Koch, president of the Koch Sand and Gravel Co., Evansville, Ind., was offered a position on the new aviation commission in that city by Mayor Herbert Males, but was forced to decline because of the press of other business. In addition to heading the gravel company which bears his name, Mr. Koch is active in numerous civic and industrial enterprises of Evansville.

Hibbard S. Greene, former vice-president and director of the Barber-Greene Co., Aurora, Ill., has been appointed assistant to the president of the Chain Belt Co., Milwaukee, Wis. Mr. Greene will coordinate the marketing plans of the Chain Belt Co., Sivyer Steel Casting Co., Federal Malleable Co., and the Interstate Drop Forge Co., all of Milwaukee, Wis., as well as the Stearns Conveyor Co. of Cleveland, Ohio, the latter company being a division of the Chain Belt Co. The same financial interests control the companies mentioned.

H. S. Greene

Leon I. Thomas, a frequent contributor to ROCK PRODUCTS columns in the past, has been appointed managing and engineering editor of Electrical Manufacturing, New York City, published by the Gage Publishing Co., Inc. From 1914 to 1925 Mr. Thomas was managing editor of "Factory," and since 1925 has been consulting editor and contributor of articles on manufacturing subjects for various industrial magazines.

Willoughby S. Leech has joined the staff of G. M. Basford Co., industrial advertising agency of New York City, and will be in charge of the branch office of the company in the Koppers Bldg., Pittsburgh, Penn. Mr. Leech has been engaged in advertising and sales counsel work for eight years, and has had sales and advertising connections with such manufacturing companies as the Westinghouse Electric and Manufacturing Co., and A. M. Byers Co.

Dr. Bernard Hague, principal lecturer in electrical engineering at the University of Glasgow, Scotland, has accepted the invitation of the Polytechnic Institute of Brooklyn to serve as visiting professor of electrical engineering at Polytechnic for the present academic year. Dr. Hague, who has degrees from the Universities of London and Glasgow, is the holder of the Siemens medal for electrical engineering and the Henrici medal for mathematics.

Manufacturers

Wagner Electric Corp., St. Louis, Mo., has appointed James G. Pattillo, Jr., as manager of its Pittsburgh branch sales office.

Gardner-Denver Co., Quincy, Ill., has moved its New York branch office from 30 Church St. to larger quarters at 147 Varick St.

Prest-O-Lite Co., Inc., New York, has placed a new acetylene gas plant in operation at 75 Kirkland St., Grand Rapids, Mich., with George Rose in charge.

Brown Instrument Co., Philadelphia, Penn., has established a factory branch at 217 E. Illinois St., Chicago, to serve its midwestern customers in speeding up shipments of instruments, parts, supplies, repairs and inspections.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has purchased the Bissell Electric Co., Toledo, Ohio. This brings the total number of large jobbing supply houses under the control of Westinghouse to 44.

Marion Steam Shovel Co., Marion, Ohio, announces that J. H. Waters, Matthew C. Brush and Morgan J. O'Brien, Jr., have been elected directors to fill vacancies caused by the resignation of J. L. Ackerson, W. F. Hoyt and F. S. Connott.

General Electric Co., Schenectady, N. Y., has been awarded contract by the Lackawanna Railroad for equipment for the substations through which the road will receive current for the propulsion of its electrified trains on the line between Hoboken and Dover, N. J.

Gears and Forgings, Inc., Cleveland, Ohio, has been awarded contract for the complete operating mechanism on the new Hackensack River Freight Line Bridge No. 421, which is being erected for the Pennsylvania railroad over the Hackensack river in New Jersey.

Hercules Powder Co., Inc., Wilmington, Del., is planning the erection of a new experimental station near Wilmington, consisting of experimental and chemical research laboratories. The company has acquired 300 acres about 2½ miles west of Wilmington city limits and, following the erection of structures now being designed, the experimental staff and research equipment will be moved here from Kenvil, N. J., the present site.

Oxweld Acetylene Co., New York City, has presented the engineering department of the University of Delaware with complete equipment, valued at $5000, for a gas welding department to be installed in the new engineering building of the university. In addition to the gift of the equipment the Oxweld company will give a course of instruction to J. L. Coyle of the teaching staff of the university in order to keep the courses in welding up to date.

Baldwin Locomotive Works, Philadelphia, Penn., at a special stockholders' meeting approved the plan for increasing the company's common stock from 200,000 shares of $100 par to 2,000,000 no par shares and issuance of four new shares for each old share. The company will acquire the Southwark Foundry and Machine Co., Philadelphia, in exchange for 43,000 shares of Baldwin new common stock. It is also planned to carry on this business at the Eddystone plants as a separate company under present officers and under the name of Baldwin-Southwark Co.

Trade Literature

Locomotives. Broadside on gasoline and oil locomotives from 3 to 100 tons. GEO. D. WHITCOMB CO., Rochelle, Ill.

Protecting Sand Cutter Blades from Wear. Reprint of article from Vol. 8 of "Oxy-Acetylene Tips," telling how Stellited sand cutter blades resist abrasion during dredging operations. LINDE AIR PRODUCTS CO., New York City.

Molds for Testing Concrete. Circular describing Cyl-O-Con Molds—cardboard forms for molding concrete cylinders used for strength tests on the job or in the laboratory. STANDARD CONCRETE APPARATUS CO., Washington, D. C.

Box Car Loader. Bulletin describing "S-A" box car loader for handling sand, crushed stone, gypsum and similar bulk materials. STEPHENS-ADAMSON MANUFACTURING CO., Aurora, Ill.

Welding Rods. Bulletin No. **3** illustrating and describing Weldite Type-T welding rods for hard surfacing tools and dies for working in metals, rocks and soils. FUSION WELDING CORP., Chicago, Ill.

Cost Finding Systems for the Terrazzo Industry. "Cost Records That Are Safe" is the title of an interesting article in the August issue of The Terrazzo News published by THE AMERICAN SURFACING MACHINE CO., Toledo, Ohio.

Box Header Boilers. Folder **BM-1**, Box Header boilers in both the Heine and Walsh-Weidner types, of single seam construction and having only a single row of rivets. COMBUSTION ENGINEERING CORP., New York City, N. Y.

Wolmanized Lumber. Bulletin on specially treated lumber which resists decay, particularly advantageous as roof-deck material for plants where wet processes or other severe rot-producing conditions exist. AMERICAN WOLMANIZED LUMBER CO., Elizabeth, N. J.

Industrial Films. How motion pictures make a live action story out of one that might otherwise be dull and can be used to advantage for advertising your products, instructing the sales force, etc., is interestingly told in a circular of the ATLAS EDUCATIONAL FILM CO., Chicago, Ill.

Pavement Tester. Bulletin No. **85-C** illustrating and describing improved gasoline engine driven pavement tester, Type 2, for removing cores from concrete pavement, permitting inspection of its structure, materials and thickness. SULLIVAN MACHINERY CO., Chicago, Ill.

OWNERSHIP OF ROCK PRODUCTS

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of ROCK PRODUCTS, published every second Saturday at 542 South Dearborn street, Chicago, Ill., for October, 1929, State of Illinois, County of Cook, ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared Nathan C. Rockwood, who, having been duly sworn according to law, deposes and says that he is the manager of ROCK PRODUCTS, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse side of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, Tradepress Publishing Corp.; Editor, Nathan C. Rockwood; Managing Editor, None; Business Manager, Nathan C. Rockwood.

2. That the owners of 1% or more of the total amount of stock are: W. D. Callender, Nathan C. Rockwood, both of 542 South Dearborn street, Chicago, Ill.

3. That there are no bondholders, mortgagees, or other security holders owning or holding 1% or more of total amount of bonds, mortgages or other securities.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest, direct or indirect, in the said stock, bonds, or other securities than as so stated by him.

NATHAN C. ROCKWOOD,
Business Manager.

Sworn to and subscribed before me this 1st day of October, 1929.
(SEAL) CHARLES O. NELSON.
(My commission expires April 13, 1930.)